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An Ore-transporting Railway in the Pyrenees

The Line Is Divided into Three Sections, Consisting of a Loading and Terminal Wire Rope Tramway, Connected by a Local Railway

BY A. GRADENWITZ*

In the most beautiful part of the eastern Pyrenees, at the famous winter resort of Amélie-les-Bains, terminates one of the most interesting wire-rope railways ever constructed for the opening up of inaccessible mining districts. Though the level differences and other difficulties to be dealt with were not such as in connection with the well-known Cordilleras railway (35 km. in length and rising to 4500 m. in hight) still its design, characterized by enormous spans traversing the most savage and cloven mountain landscapes, renders this plant of unusual interest.

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Valentine Brothers, of Paris, are the owners of an extensive iron deposit below Mount Canigou, a peak 2800 m. in hight, covered with everlasting snow. The average iron content of the ores is 50 per cent. The ore is taken either to Port Vendre on the Mediterranean, in order to be loaded on ships and conveyed to English metallurgical works, or transported direct by rail to the Schneider works of Creusot.

FIG. I. SURFACE PLANT AT THE MINE SHOWING LOADING STATION OF THE AERIAL TRAMWAY

Mining and Loading the Ore

The process of working the ore is fairly simple: Galleries driven at different hights are connected by vertical shafts through which the ore is dumped toward the lowermost gallery; there it is loaded into trucks and taken to the bunker of the wire-rope railway (Fig. 1). The mines are at present being equipped with electrical drills and locomotives. The whole of the transporting plant, from the La Pinouse mines, situated at 1350 m. hight, down to Amélie, was divided into three sections corresponding to the special nature of the mountains, viz., two wire-rope railways and a local railway connecting the two. While not great, the level difference negotiated by the upper wire-rope railway, 1.3 km. in length, is sufficient for the railway to work independ-

ently, with a surplus of 10 h.p. which is used up by hand-regulated bands. The wire-rope trucks are loaded from a bunker erected on the mountain slope and are despatched at regular intervals.

The most interesting part of the upper wire-rope railway is the huge span (Fig. 2) traversing a deep valley 450 m. in width, immediately before the discharging station. Down in the valley are situated the water-power plants built by the mining company for supplying the mines with power and light.

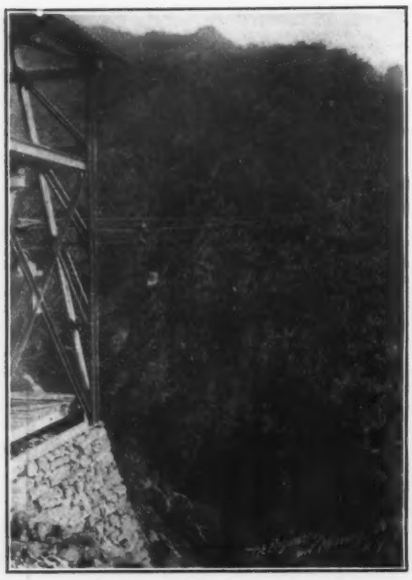

FIG. 2. SPAN OF 450 METERS AT UNLOADING STATION, RAPALOUN

FIG. 3. TOWER 35 METERS HIGH

FIG. 4. UNLOADING STATION AT RAPALOUN

FIG. 5. ORE BINS ABOVE LA REDOUTE LOADING STATION

FIG. 6. UNLOADING BINS AT RAILROAD STATION AT AMELIE-LES-BAINS

The Railroad Section

The station of Rapaloun (Fig. 4) is erected on a steep rocky wall towering from the valley where the transfer is effected into the cars of the local railway. The ore is then transported in trains by tender locomotives to the station of La Redoute, 14 m. distant (Figs. 5 and 8). The entire tonnage is handled by three locomotives, carrying in each train 50 tons of ore. Having a level difference of only 200 m. the railway is situated throughout its length on mountain summits, the steep descent down to Amélie only beginning behind La Redoute. The station forms the center of operation for the local and wire-rope railways and with its extensive plants, repair shops and dwellings for machinists, guards and locksmiths, resembles a small village.

Transfer to the Terminal Section

The transfer of the ore is effected in the usual manner by means of a bunker into which the tilting cars are dumped. In front of the ore bunker extension, within the substantial lining wall, the wire-rope trucks are shoved along and filled, after which they are coupled in the station to the rope for transfer to the terminal section, 4½ km. in length leading down to Amélie. The difference in level is here nearly 900 m. and with a load of nearly 50 tons a surplus of nearly 100 h.p. is developed. On account of the enormous level difference, the railway has been subdivided into two sections of equal length with an intermediary station at the village of Can Kirk. At that intermediary station, as well as at La Redoute, are installed hydraulic braking regulators, designed as vane pumps, driving water through a narrow slot. The resistance varies according to the number of descending trucks, which obviously cannot be kept constant, as well as to atmospheric conditions, so that the braking effort must be altered by narrowing or widening the slot so as to keep the speed constant. This is effected by a centrifugal regulator connected to the traction rope, which with any alteration in speed, adjusts the width of the slot.

The railway on its way to Amélie-les-Bains traverses several wide valleys

Fig. 3 represents one of the lofty supports which on either side of these valleys form the last abutment of the rope. At the station of Can Kirk, the trucks are loosened from the rope and, owing to their live force, they go on over the slightly sloping suspended rail, deviating laterally, and are again coupled, at the station, to the track rope of the lowermost section. The railway gradually descends, penetrating into the vineyard district of Amélie (Fig. 7) and, terminating at the railway station of Amélie-les-Bains, where another large bunker for receiving the ore has been erected (Fig. 6). By means of folding chutes, the ore is drawn off into the cars of the Southern Railway Company and taken to its final destination.

Construction

As regards the construction of the railway, it may be said that the whole of the runway consists of closed ropes offering a smooth surface to the rollers so as to be subject to less wear and tear and to put the rollers to less strain than would a spiral rope consisting of round wires. A clutch of standard Bleichert design is used for connecting the trucks with the traction rope. This clutch, which in the present case acts on the lower rope, is constructed in one with the driving gear, insuring the vertical suspension of the car independently of any inclination of the supporting rope. A special advantage of this design is that ropes of fairly different diameters are seized with the same security which in this special case is especially welcome, as the traction ropes on the two sections of the lower wire-rope railway are never stretched with absolute uniformity and accordingly are bound in the long run to assume different dimensions. The traveling speed on the upper wire-rope railway is 2 m. and on the lower 2.5 m. per second. The plant was constructed by Adolf Bleichert & Co.

FIG. 7. TOWER ON LOWER TRAMWAY NEAR AMELIE-LES-BAINS

FIG. 8. LA REDOUTE STATION, SHOWING BEGINNING OF LOWER TRAMWAY

Prospecting for Ores of the Goldfield Type

By J. Volney Lewis*

"In the Goldfield district alunite is so abundant and so generally associated with the intense alteration accompanying ore deposition that it must be looked upon as one of the most characteristic minerals of the gold deposits."[1] With this announcement Ransome not only added a new type to the geology of ore deposits, but pointed out a most promising new field for exploitation. The prospector, however, has not rushed in to possess the new land. He has rather roamed about blindly over vast areas of desert and mountain in the hope that somewhere, somehow, he would stumble upon the coveted treasure; but no practical means has been put into his hand for recognizing the ore he seeks.

There is gratifying evidence that the scientific prospector, the mining geologist,[2] is availing himself of the new knowledge to more purpose; but the vast area that may possibly bear this type of ore is too much for the few scientific men who are in the field. If the present generation or the next is to realize in any large degree the possibilities that have been opened up, we must enlist the larger army of practical mining men.

The Prospector's Dilemma

The prospector who knows his porphyry, his limestone, and the honeycombed rusty gossan that bespeaks the deeper-lying sulphurets has been taught by long experience to disregard all manner of whitish or grayish or clean-looking rock. The big mines that he knows have been opened on very different looking ledges, and only a tenderfoot would pause for a second look at the unstained outcrop. To the prospector in the desert all this has now been changed. If he has learned the lesson of Goldfield he knows that amazing values have been developed there in a beautifully white porcelain-like material for all the world like the most barren porphyry; and now others are duplicating this Goldfield experience in far-away corners of the desert, while vast inviting fields still lie unexplored.

I do not mean to say, of course, that iron-stained material is not found at Goldfield, both on the outcrops and in the mines, but merely that this is not a necessary or characteristic feature of deposits that carry high values.

Under such conditions what is the prospector to do? He cannot sink pits on every ledge, whether rusty or white, and have assays made all over the face of the earth. Besides, the assayer may miss the main point altogether. There may not be enough gold in the cropping or in the shallow pit to excite the mildest interest, but if alunite is there the prospector wants to know it, whatever the values, for it is worth while to follow it down a bit and try the assayer again on the deeper levels. Of course, alunite does not everywhere and under all conditions indicate the presence of gold; neither does rusty quartz nor any of the various "indications" by which the prospector is guided; but the abundance of the mineral and the constancy of its association with the ores at Goldfield, followed now by a similar occurrence in a new locality, are extremely suggestive; and there are large areas in the Southwest where geological conditions are closely similar.

Mineral Characters and Occurrence of Alunite

Alunite occurs in hard, white, porcelain-like masses, or in fine-grained condition like loaf sugar. In the latter case it is

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[1]F. L. Ransome. "The Association of Alunite with Gold in the Goldfield District, Nevada." *Economic Geology*, Vol. II, 1907, p. 669.

[2]R. T. Hill. Engineering and Mining Journal, Dec. 5 and Dec. 12, 1908.

either firm like marble, or it may be easily crumbled into a snow-white mass resembling pure kaolin and difficult to distinguish from it in the mines. At Goldfield it often has a pale pinkish color, while the kaolin is white. Sometimes it is found in little square-looking crystals (rhombohedrons) which form nests in the small openings of the rock, but these are rare and have never been seen as large as ¼ in. in diameter. The mineral is easily scratched with a knife (H. = 3.5 — 4), which would serve to distinguish it from similar masses of quartz and feldspar (H. = 6 and 7, respectively); but feldspar that is changing to kaolin would be soft also, and alunite is often so intermingled with both quartz and feldspar that its true characters are entirely masked. The fact that a substance does not readily yield to the point of the knife, therefore, is no proof that alunite is absent. The character of alunite and its frequent association with sulphides also prevents the use of any simple blowpipe test for its recognition.

Alunite has been found with gold in a number of closely related types of volcanic rocks (rhyolite, latite, andesite, etc.), all of which are generally gray or greenish or some lighter color, unless stained by iron from decomposing sulphides, and are generally known to the miner and prospector as "porphyry." It does not occur in these rocks in their unchanged natural condition, but has been formed along planes of fracture and crushing produced by faulting. But the rock that was crushed by the grinding of moving masses upon one another has been in many cases firmly cemented together again by the quartz that has been deposited through it. Hence it may be as hard as any of the country rock; but its color is usually changed in the process, and it is often much whiter, except where stained by iron from rusting sulphides. Pyrite often accompanies the alunite in these altered rocks, and gypsum is frequently found in very soft, white films along the cracks and seams.

Use of the Microscope

If a rock specialist from some college or university should turn prospector he might utilize his knowledge that a thin section of the rock under the petrographic microscope usually affords an easy method of recognizing the elusive alunite; but, like the prospector who must have everything assayed, he would work at a great disadvantage because his method cannot be carried into the field. He must grope in the dark, collecting materials from faulted and altered rocks for innumerable thin sections, and must await their preparation and examination before he knows whether he has found a promising locality or not. Besides, even the petrographer must sometimes halt between two opinions when the microscope fails to distinguish alunite from extremely minute particles of quartz and feldspar. In such cases the chemist must be called in to make the final decision.

The Appeal to Chemistry

The chemist, then, is the man to whom we naturally turn for the practical key to the situation. A short, reliable chemical method is what the prospector most needs, requiring only materials that can be carried into the desert with him without hampering his movements or restricting his grub supply. It is just this need that Mr. Gage has undertaken to meet in the second part of the accompanying paper.

In the microscopic study of alunite-bearing rocks I have often found that the results required chemical confirmation. Fortunately, Mr. Gage, who did this work for me, brought to the task not only a full understanding of the difficulties to be overcome, but also the ability to devise effective methods. In the absence of established methods for analyzing such complex mixtures of sulphates, sulphides and silicates, he has worked out the procedure which he describes in the first part of the accompanying paper, and the results have been highly satisfactory. With a view to making the method immediately available to the prospector or engineer in the field, he has further devised a qualitative modification which should not prove difficult for the nontechnical man. It is earnestly hoped that it may serve the prospector's purpose in searching for the Goldfield type of ores, which until now he has had no means whatever of recognizing.

Determination of Alunite

By R. B. Gage*

The importance which the mineral alunite has attained in the last year and a half on account of its association with and relation to the gold ores of Goldfield, Nevada, makes a method for its determination very desirable, not alone for its quantitative estimation in the laboratory, but one that can be applied in the field qualitatively in order that the presence or absence of alunite may be determined at once. This would be a comparatively easy matter if the mineral did not occur associated with other sulphates and often also with sulphides.

Alunite is a basic sulphate of potassium and aluminum whose composition may be expressed by the formula,

$$K(AlOH)_3(SO_4)_2.$$

Sodium may replace a portion of the potassium. Since the deposits of this mineral with gold seem to have been formed by the action of sulphuric vapors on feldspars, more or less gypsum is naturally to be expected if the original rock contains any of the lime-bearing, or plagioclase feldspars. Microscopic examination, by J. Volney Lewis, shows that both orthoclase and plagioclase feldspars are always present, and in nearly all specimens of the altered rock examined by me more or less gypsum has been found. Sometimes it is present in much smaller amounts than alunite, but often just the reverse is true.

Although alunite is affected but little by either strong or dilute hydrochloric acid, it is slowly soluble in strong sulphuric acid and is also readily decomposed by hydrofluoric acid. When the mineral is heated alone to a dull red it is decomposed with the formation of alum and the loss of water and more or less sulphur trioxide. At a higher temperature the latter is given off freely.

Quantitative Determination

I. In the Absence of Sulphides—For the quantitative estimation of alunite an indirect method must be employed in order to separate it from the other sulphates. When no sulphides are present a total sulphur determination is made as follows: One gram of the powdered material is mixed with five grams of sodium carbonate, to which is added a small crystal of potassium nitrate, in a platinum crucible of 30 c.c. capacity. The crucible should be heated first over a Bunsen burner and then over the blast until the material is completely decomposed. When the fusion no longer continues to give off bubbles of gas this point has been reached. The crucible should rest in an opening cut to fit accurately in a piece of asbestos cardboard in order to guard against the absorption of sulphur from the gas. The flame from the blast should heat that part of the crucible beneath the asbestos board to a uniform temperature; that is, a broad flame should be used rather than a pointed one.

The melt is digested in about 200 c.c. of hot water until completely dissolved, and then filtered. The filtrate contains all the SO_3 in the sample, together with more or less silica and alumina. The volume of the filtrate should not be less than 250 c.c., and it must be neutralized very carefully (with strong hydrochloric acid) or silica will separate out. If the acid is added slowly while the solution is stirred silica is sure to precipitate. When this happens the silica will have to be dehydrated by evaporating to dryness or another fusion must be made, as it is impossible to filter the gelatinous silica. A blank should be run, using the same weight of chemicals and the exact amount of strong hydrochloric acid added that will be required to decompose the carbonate used. The end point can be easily determined by adding a drop of methyl orange, which is not affected by the CO_2 given off.

To the filtrate from the fusion of the mineral the required amount of acid and

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about 1 c.c. in excess is added by allowing it to flow slowly down the side of the covered beaker. The solution should be set to one side until the acid has worked its way nearly to the bottom of the liquid, which it will soon do as the escaping gas keeps the liquid in motion. When the carbonates have nearly all been decomposed the solution should be stirred up vigorously for a moment and then heated to boiling. It should remain perfectly clear. If a slight precipitate appears, it should be filtered off. In either case 25 c.c. of hot barium chloride solution are added to the boiling solution and the mixture kept near the boiling point until the precipitate has settled, leaving the solution quite clear. Since the precipitate has a tendency to pass through an ordinary filter paper, a very thick one should be used. The clear liquid is gently decanted through the filter without disturbing the precipitate any more than necessary. After discarding the filtrate the precipitate is transferred to the filter and washed free from chlorides with hot water. The paper and precipitate are then transferred at once to a weighed platinum crucible and gently ignited over a Bunsen burner, cooled and weighed.

If there is any reason to suspect that the precipitate of barium sulphate is contaminated with silica or has been reduced on ignition of the filter paper, it should be moistened with water containing a few drops of hydrofluoric acid and a drop of sulphuric acid added. After evaporating to dryness a few drops of ammonia should be added and then expelled by heating. A second treatment with ammonia may be necessary in order to remove the last trace of sulphuric acid added. The crucible should be heated to a dull red after each treatment. It is finally heated to a bright red over a Bunsen burner, cooled and weighed. From the total SO_3 thus secured deduct the amount found to be present in sulphates other than alunite. The remainder thus determined, when multiplied by 2.5906, will give the alunite content of the sample.

The Separation of Gypsum—The method for the separation of alunite from gypsum is based on the insolubility of the former and the solubility of the latter in distilled water. Since it requires about 425 c.c. of water at 90 deg. C. to dissolve one gram of gypsum, the volume of the solution should never be less than 300 c.c. This amount will usually insure a large excess of the solvent, since the sample will seldom contain as much as 50 per cent. of gypsum. It is always advisable, as a check, to determine both the CaO and the SO_3 in the solution of gypsum, for often the sample will contain small amounts of soluble sulphates other than gypsum.

A test was made on a sample of nearly pure alunite and 0.34 per cent. of SO_3 was found to be soluble in hot water, although no CaO nor Al_2O_3 was dissolved. It is possible that this SO_3 may have come, in part at least, from the alunite, but since the specimen was not entirely pure and the amount of SO_3 taken into solution was less than one-hundredth of 1 per cent. of that present in the mineral, it is assumed in the method of procedure here described that the alunite is entirely insoluble in water. Therefore, any excess of SO_3 in the water solution over what is required by the lime to form gypsum may be assumed to come from soluble sulphates other than gypsum and is to be deducted, along with that in the gypsum, from the total SO_3 in the rock in order to determine the amount present in alunite. Sometimes the CaO in the water solution is in excess of the amount required to combine with the SO_3 to form gypsum. In this case it is impossible to tell whether or not any other soluble sulphates are present.

The actual operation is carried out as follows: One gram of finely powdered material is digested with 300 c.c. of distilled water for about one hour. The aqueous extract is filtered through a very thick filter paper (or two papers), as some of the undissolved sample will usually pass through an ordinary paper. The filtrate is made slightly ammoniacal and heated for some time. Should a slight precipitate appear it is filtered off. In either case the CaO is precipitated in the hot filtrate as the oxalate. The solution should be kept near the boiling point for at least 30 min. before filtering. A re-solution and reprecipitation of the lime is not necessary, since little or no magnesia is present.

A prolonged washing of the precipitate should be avoided, since calcium oxalate is not totally insoluble in hot water. Paper and precipitate are transferred without drying to a platinum crucible and the paper slowly incinerated. After the precipitate has been heated over the blast lamp for a few minutes it should be cooled and then moistened with a few drops of water and the same slowly evaporated off, when it is again heated until it no longer loses weight. It should always be cooled in a desiccator and the weighing done as rapidly as possible, as it absorbs moisture quite repidly from the air.

The filtrate is then made slightly acid with HCl and the SO_3 determined in the manner described above. The presence of oxalic acid will doubtless cause a slight error by keeping a small amount of barium sulphate in solution, but it is probably no greater than that which would be caused by the contamination of barium sulphate with calcium salts if the SO_3 was determined without first removing the lime.

From the amount of CaO and SO_3 found the gypsum content is calculated. The SO_3 of the gypsum, plus that of other soluble sulphates present, is deducted from the total amount of SO_3 found in the rock in order to determine the SO_3 contained in the alunite. Should the material contain other insoluble sulphates than alunite, which is possible but not very probable, the results thus secured will be correspondingly high.

Owing to the nature of alunite and the substances that are usually associated with it, the results obtained by the methods described above do not possess the high degree of accuracy attained in the better analyses of ordinary rocks. In most cases, however, the errors will be so small that they may be neglected.

II. When Sulphides are Present—When pyrite is present the total SO_3 cannot be determined by the method given above. In this case a gram of the powdered material is transferred to a 300-c.c. platinum dish and decomposed with hydrofluoric acid. The residue after evaporation is moistened with strong hydrochloric acid and again evaporated to dryness, in order to expel as much of the hydrofluoric acid as possible. After moistening the residue again with a few drops of hydrochloric acid, it is digested with about 250 c.c. of hot water until all the soluble salts have gone into solution. It is then filtered and well washed with hot water. The SO_3 is determined in the filtrate in the manner described above.

Pyrite is attacked but slightly, if at all, by hydrofluoric acid. The solution should contain a little free hydrochloric acid in order to prevent the precipitation of barium fluoride with the sulphate, but too much acid will also prevent the complete precipitation of the barium sulphate. The hydrochloric acid used to moisten the residue may be sufficient if the final volume of the filtrate is not much over 300 c.c. If the precipitate is thought to be contaminated with barium fluoride, which is generally the case, the supernatant liquid is gently decanted, 2 c.c. of strong hydrochloric acid added, and the contents of the beaker gently warmed for a few minutes, when it is again diluted to about 300 c.c. and allowed to stand the usual length of time before filtering. Barium fluoride is a white flaky precipitate that will not settle to the bottom of the beaker like barium sulphate, hence anyone familiar with the appearance of the latter will have little difficulty in distinguishing it from the former, unless the amount of the barium fluoride precipitated is quite small compared to that of the barium sulphate. In this case it is impossible to distinguish them.

Qualitative Determination in the Field

A chemical test for the presence of alunite is a very simple matter and can easily be made in the field where water that is free from sulphates can be obtained. The necessary apparatus includes two or three pint tin cups (or tin cans may be used), a small mortar, and a spoon, cartridge, or other measure that will hold about a gram (15 grains) of the

powdered rock. (A 0.44 caliber cartridge one inch long will hold about half a gram of powdered rock.) A few ounces of barium chloride will also be needed.

When a test is to be made for the presence of alunite a small piece of the rock is first pounded up with a hammer and then ground to a fine powder in the mortar. About a gram of the powder is measured out into a tin cup which is nearly filled with water. The water is then boiled for 15 or 20 min. and allowed to stand until all the powder has settled. The clear water, which contains in solution whatever gypsum was present, is then gently poured into another cup or can *A* without removing any more of the powder than absolutely necessary. The undissolved powder is then dried in the cup and heated to a dull red, after which it is allowed to cool and again boiled with water as before, in order to dissolve the decomposed alunite. After the remaining powder has settled the clear water is then gently poured off into another cup *B*.

A small portion of the barium chloride is now dissolved in a little water, which should give a clear solution or be only very slightly clouded. The water in both the cups *A* and *B* is heated nearly to boiling and some of the barium chloride solution added to each. If either solution becomes cloudy it is proof of the presence of sulphates. If *A* is clouded and *B* remains clear, the rock contains gypsum but no alunite, while if *B* is clouded and *A* remains clear, alunite is present without gypsum.

In the arid regions of the West and Southwest the waters frequently contain sulphates, and this, it is feared, may prove the chief source of trouble in the application of the method. In any case it is always well to test the water before going to the trouble of preparing the rock powder. Take a little of the water in a cup and add a few grains of the barium chloride; if more than a very slight milkiness is produced this water cannot be used in the determination, since the sulphates in it would prevent the detection of those in the rock.

When suitable water can be procured any prospector can easily and quickly apply these tests after a little practice. Thus he may know positively whether or not alunite is present, and if it is he may prepare to sink deeper with a reasonable expectation of finding gold also. A rough estimate of the amount of alunite present may be made from the quantity of precipitate that clouds the water in *B* when the barium chloride solution is added. In making these tests it should be remembered that alunite is insoluble in either hot or cold water, and that it is decomposed and made soluble only when it is distinctly heated to a dull red. Care must be taken, however, not to heat the powder to a bright red, as this would drive off some of the sulphur trioxide which is easily recognized by its pungent odor. When this happens a fresh sample should be taken and another test made.

A Triangulation Station

By Lee Fraser*

For purposes of triangulation the chief requirements of stations consist in permanency and proper location, so as to be at all times visible. After considerable experience in surveying where the underbrush and forest growth is dense, a triangulation point, properly located, and constructed in the following manner was found to give satisfactory results:

The bill of material for one station consists of the following: 48 in. of 2¼-in. galvanized iron pipe; 8 in. of 1-in. brass or copper tubing; 72 in. of ½-in. round iron; 14 ft. of 1¼-in. galvanized iron pipe; 1 reducer, 2¼x1¼ in.; 40-ft. wire; 1 target; 100 lb. portland cement; 1000 lb. crushed stone, and three 2-ft. wooden stakes. The total time required by two men, for the construction of one station was two hours, all the material being on the ground with the exception of the stone, which was gathered from the hillside, and water, which was procured from a nearby stream.

After excavating a hole of proper dimensions, the 4-ft. length of 2¼-in. pipe reinforced by six 12-in. lengths of ½-in. round iron, is placed upright in the hole, and concrete (1-10) tamped firmly around it. Especial care must be taken in securing the pipe in a truly vertical position, for upon this condition, is dependent the verticality of the flag. After placing the base pipe (Fig. 2) in position, the interior is filled with concrete to within 10 in. of the top, and thoroughly tamped. The pipe is next filled with mortar to within 3 or 4 in. of the top, when the 8-in. brass or copper center, open at the bottom, but brazed at the upper end, is inserted in the mortar and thoroughly worked up and down to cause the mortar to pack firmly in the tube. It is then set with the upper end 1 in. below the end of the large pipe, insuring ample protection to the surface upon which the center mark is inscribed. Upon careful centering of the copper center tube the horizontal difference from coincidence between the axis of the flag and the center mark must be slight, and of so little importance as to be sufficiently accurate for the great majority of purposes. When the main pipe is thoroughly set, the attaching of the flag is a simple matter.

The flag being gray is readily distinguished against almost any background and especially against forest growth. When there is probability of confusion of the stations with one another, an excellent mark, and possessing the advantage of being distinguishable from any paint, is some geometrical figure, such as a sphere, a cone or cylinder made of wood and placed upon the top of the signal. When the pole is liable to incline, due to heavy winds, it is well to attach guy wires to insure rigidity, but it is exceptional when this measure must be used. To facilitate observations for elevation, a red and white band is painted about the pole, the junction of the two colors being a certain known distance above the station.

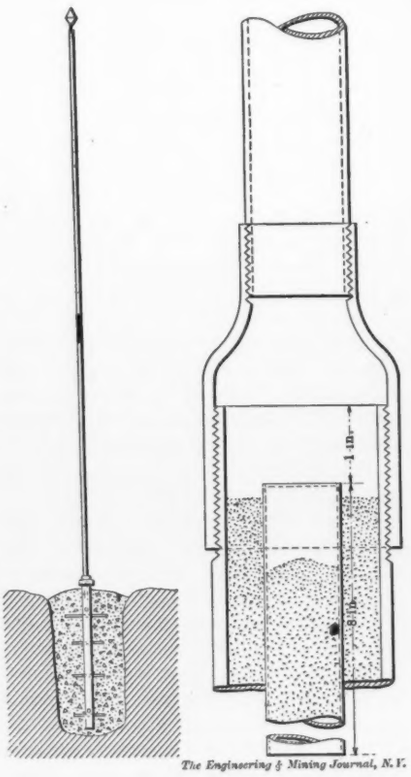


FIG. 1. TRIANGULATION STATION AND METHOD OF CONNECTION

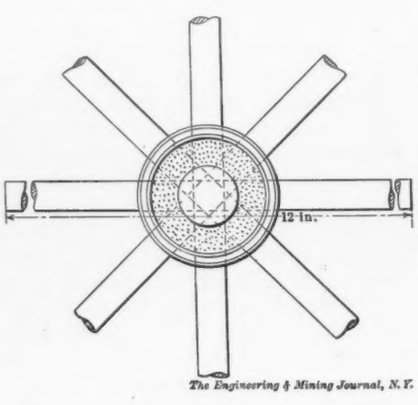


FIG. 2. BASE PIPE OF TRIANGULATION STATION

*Mining engineer, Aguacate Mines, San Mateo, Costa Rica, Central America.

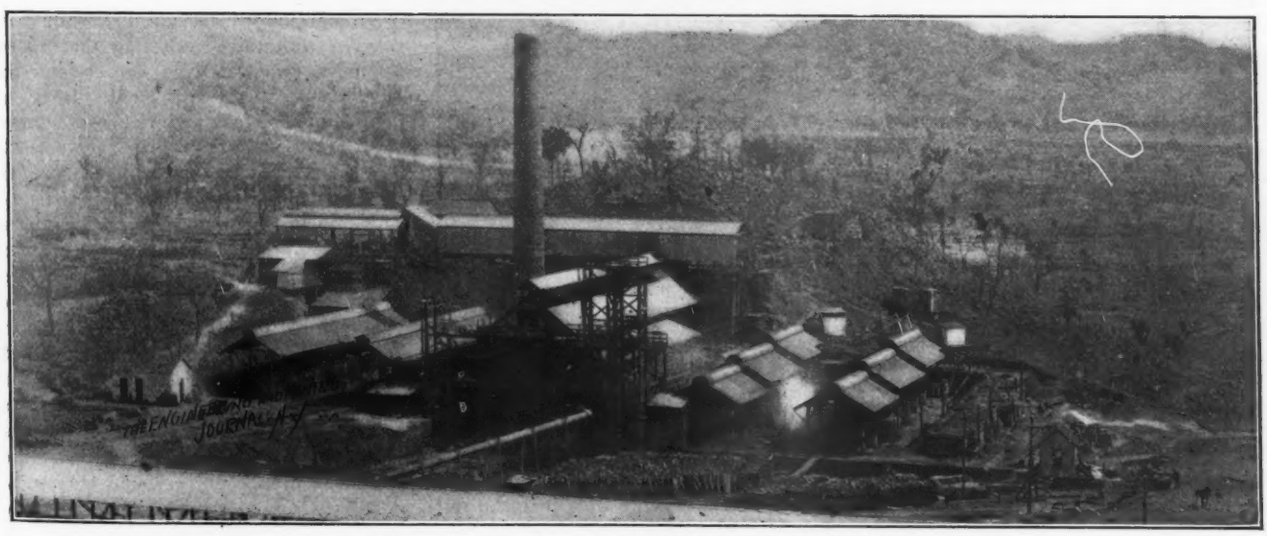
Copper Mines in Chillagoe District, Queensland

Some Isolated Properties in Northeastern Australia where Small Scale Smelting Operations Have Been Successfully Conducted

BY GERARD W. WILLIAMS*

In addition to the copper mines of Chillagoe already described in my previous article on "The Mining Industry in Queensland," in the JOURNAL of March 20, 1909, there may be cited some other copper properties of this northern section that are examples of small scale smelting operations successfully carried on at mines that are some distance from the railroad. The O. K. mine and smeltery have already been described. In addition, the Mount Molloy mine may be instanced and a brief description of its operation will be given, but before proceeding with this account, attention will be directed to the accompanying illustrations of the lead and copper smelting plant of the Chillagoe Railways and Mines, Ltd. The complex ores contained in this company's properties and the reduction works were described in the previous article.

GENERAL VIEW OF LEAD AND COPPER SMELTING PLANT AT CHILLAGOE, QUEENSLAND



HUNTINGTON-HEBERLEIN ROASTING PLANT OF THE CHILLAGOE COMPANY

THE MOUNT MOLLOY MINES

The Mount Molloy copper mine is situated 20 miles north of Biboorha on the Cairns-Chillagoe railway line. The country consists of slates and sandstone with intrusions of acidic rocks. The lode channel itself follows the course of a dike of felsophyre which can be traced for a considerable distance across the surface of the country. The ore is comparatively low grade and is sorted in the stopes. The mining practice presents no particular points of interest. The smelting plant comprises a water-jacket furnace, 90x36 in. at the tuyeres and 10 ft. 6 in. to the feed floor. The matte gravitates to a reverberatory where it is

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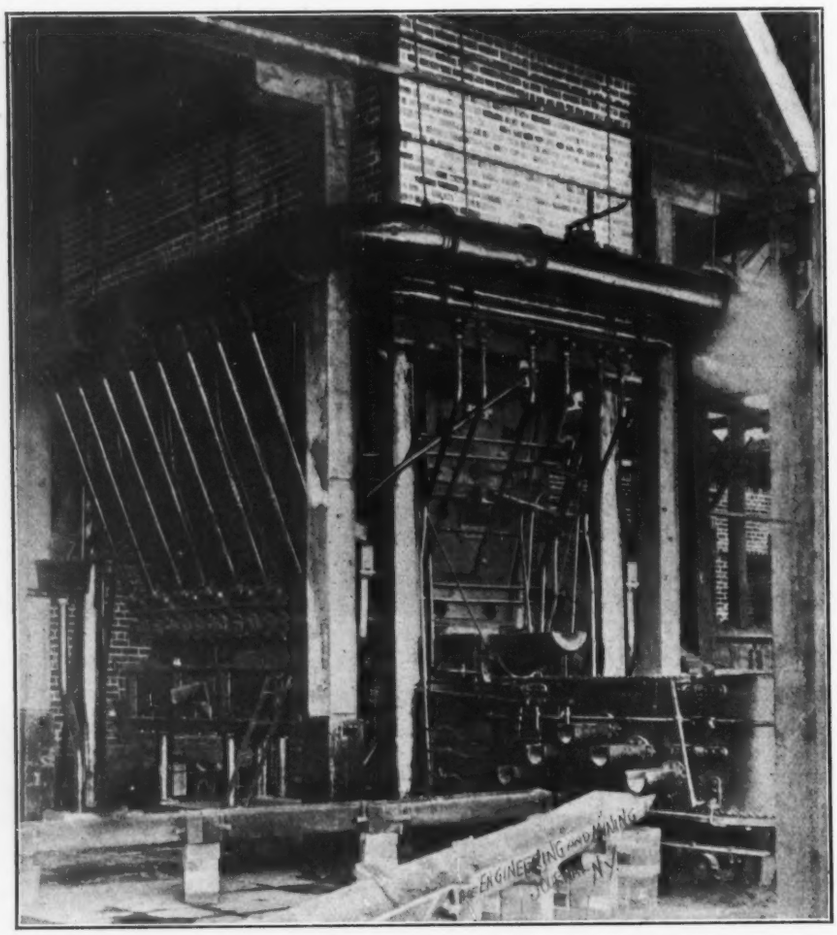
kept warm till such time as it is wanted by the converter. The output is insufficient to keep the converter continually in action so the converter plant only runs two shifts and the night shift matte is stored in the reverberatory furnace. This method appears to be more expensive than the O. K. mine practice where mattes produced on night shift are returned to the furnace in the morning.

The analyses in the accompanying table indicate the nature of the ores treated.



COPPER MATTING FURNACE OF THE CHILLAGOE COMPANY

ANALYSES OF MOUNT MOLLOY ORES.

	Chalcopyrite Ore.	Semi-sulphide Ore.	Carbonate Ore.	Pyrite Flux.	Iron Flux.
SiO_2	33%	58%	64%	28%	12%
FeO	20	10	4	28	70
Al_2O_3	3	7	8	3	.....
CaO	1	.....	.....	1	2
MgO	6	.....	.....	6	.....
ZnO	7	3	.....	8	.....
S	19	3.5	.....	45	.....
Cu	7	14	11	2	0.5

The charge is made up approximately as follows: Chalcopyrite ore, 10 cwt.; pyrite flux, 4; semi-sulphide, 1; iron flux, 3; limestone, 2; flue dust, 2; converter slag, 1; coke, 2. The furnace treats about 130 tons of charge per day exclusive of coke. The slags average: SiO_2, 39.9 per cent.; FeO, 30.4; CaO, 9.9; ZnO, 6.5; Al_2O_3, 8.0; MgO, 3.2; S, 0.7; Cu, 0.43. The mattes produced average 50 per cent. copper.

The presence of zinc in the ore is by no means a favorable indication, for thus far mines in North Queensland which contain zinc have failed signally to develop well in depth. This mine has attained a depth of 430 ft. but the ore body is smaller at that depth and appearances generally are not very favorable. The Mt. Garnet copper mine in the Koorboora district started off well but shortly after smelting operations started and about the time that the railway was extended 35 miles to the mine, the copper ore passed into zinc ore and the mine closed down. In depth the zinc seems to entirely replace the copper or it may be that the copper is really only a secondary replacement of the zinc blende.

Unlike most mining camps this mine is situated in the midst of beautiful country. The great tropical forests of the coastal range come down to within a few miles of the camp and the immediate neighborhood of the mine is well-grassed, park-like country. The company owns large timber concessions and is opening up a large export trade in timber. With the gradual depletion of the more available timber supplies the Queensland timber must come into considerable demand. One of timbers obtained here, the crowsfoot elm is equal if not superior to the best hickory or ash for the making of pick or ax handles, and for mining purposes the spotted gum is largely used. Cedar, pine and Morton Bay ash are shipped to the southern states.

Einasleigh Copper Mine

This promising mine is situated about 110 miles south of Chillagoe. The lode occurs in black mica schists lying on the contact of granites. The mine has been opened up to 300ft. in depth and developments are satisfcatory. Some time ago, the company attempted blast-furnace smelting with charcoal but the attempt was not successful. The advent of the new Ethridge railway, however, will enable coke to be obtained at a reasonable price. Unfortunately the mine promises to be highly silicious and concentration methods will have to be adopted as there is no iron flux obtainable locally. The outcrop is almost entirely covered by a flow of basalt of Tertiary age. The only portion visible is in the bed of the river where the waters have cut through the basalt sheet and have exposed the older rocks beneath.

Around the Einasleigh the country is covered with this basalt flow, but about 35 miles away a large copper outcrop has recently been discovered. It is of considerable extent and richness. Other small prospects have recently been opened, the new railway from Chillagoe to the Ethridge having given a great impetus to prospecting of all descriptions. The great need of northern Queensland is railways and it is to be regretted that there is such strong opposition to the building of private lines. The labor-democratic party opposes all lines owned privately and the state is not in a position to construct purely experimental lines from the public funds. If private enterprises were given a free hand the whole northern country would be speedily opened up, to the ultimate advantage of the state. But Queensland like the rest of Australia suffers from over-legislation and largely at the cost of the mining industry, which appears to be especially selected for experimental legislation.

Sheffield University, England, is installing an electric-steel furnace of the Kjellin type, to be used for experimental purposes.

The Gem Bearing Pegmatites of Western Maine

Deposits, Operated by Open Cut, Produce Tourmaline, Beryl, Feldspar and Mica. The Gems Occur Principally in Pockets in the Narrower Dikes

BY W. ROGERS WADE*

The discovery of tourmaline in Maine is credited to two students, Hamlin and Holmes, who were gathering specimens near the town of Paris in western Maine, in the autumn of 1820. Some crystals of green tourmaline were found, with which they were not familiar, and the specimens were sent to Professor Stillman of Yale for identification. In those days tourmaline was not used as a gem stone and the deposit was regarded as a mineralogical storehouse only. It was not till 1880, about 60 years after its discovery, that this deposit, now widely known to mineralogists as the Mount Mica mine, was opened as a mining property. So far as I can learn, this was the first gem deposit of value discovered in the United States.

The Pegmatite Area

The area of granite pegmatites extends in a general northwest direction from the Kennebec river in Maine to New Hampshire. They compose a broad band of country 25 to 30 miles wide and occur as parallel dikes and sills between the bedding of older schists, gneisses and limestones. But few of these pegmatites are gem bearing and it is the purpose of this paper to treat only of those that are. The section in which the gem-bearing pegmatites occur extends from Auburn to Newry, Me., an area about 70 miles long by 15 miles wide, and near the center of the larger zone. Their general strike is northwest and the average dip between 10 and 20 degrees to the northeast. They occur in connection with large granite areas.

The southwestern side of the belt is flat or slightly rolling country, and the valleys are filled with glacial sands. On the northeastern side the country is hilly with many rock outcrops. The pegmatites themselves, while they are easily disintegrated, do not weather away as fast as the mica schists above them. As a result their outcrops often form long low bluffs as at the Pulsifer and the Maine Tourmaline Company's mines in Auburn. They are more apt to outcrop on the hillside than on its very top. The Mount Mica mine is an exception to this.

Characteristic Coarse Structure

The most pronounced feature of the pegmatites is their coarse structure. Quartz crystals 2 to 3 feet in diameter are encountered, while feldspar crystals weighing a ton or more are met with. Some of the pegmatites not carrying enough tourmaline to be of economic value are often so rich in bands and masses of feldspar that they are mined for that mineral, which is ground and used in the manufacture of pottery. Large beryl crystals are apt to occur in these feldspar mines. One beryl crystal, encountered at the Berry mine in Poland, Me., was reported as being 6 ft. in diameter. At Buckfield in a tourmaline mine, quartz crystals are found so large that two men cannot lift them.

Another absolutely essential characteristic of gem pegmatites is that they shall be rich in lithia minerals. This is due to the fact that gem tourmaline must have at least one half per cent. lithia among its bases. The lithia minerals, especially lepidolite, concentrate around the pockets or gas cavities in which the gems occur, and are used by the miners as indicators that they are nearing a pocket.

These dikes all show a banded structure. Next the hanging-wall is a medium-grained band about as coarse as ordinary building granite, called graphic granite. This consists of a feldspar groundmass with lens-shaped quartz crystals, distorted by flowage while cooling, and a small amount of biotite mica. Below this occurs the zone of huge crystalization. In it are great mica plates, quartz masses and crystals, and masses of soda feldspar or albite. In the lower part of this zone, and often at the juncture with the one below, occur the gem pockets, lepidolite and practically all the rare minerals. It is locally called the "mineral sheet." Below this comes a band of nearly pure potash feldspar. On the underside of this feldspar, where it joins the next zone, is a narrow band of garnets from one to two inches thick. This is called the garnet streak and marks the lower edge of the vein commercially. The next zone below this is another biotite graphic granite, under which is the footwall.

Associated Minerals

A complete list of all the minerals found in these pegmatites counting those of rare occurrence would run into the hundreds. The most common besides the quartz, feldspar, and mica which compose the bulk of the dikes, are cleavelandite, lepidolite, black tourmaline, lithia or gem tourmaline, beryl, apatite, spodumene, cæsium beryl, compounds of tin, manganite, triphylite, lithiophilite, beryllonite, cookeite, bertrandite, montmorillonite, topaz, garnet, zinc spinel, herderite, and a host of the rarer minerals occur sparingly.

The only gems suitable for cutting in these deposits are tourmaline and beryl. The tourmalines are red, blue, green, white or pink, the red and green shades being the most desirable. Often several colors are found in the same crystal, varying from tip to tip or from the center outward. The beryls are either white, blue or yellow in color. The white beryls are brilliant when properly cut, but having no distinctive color are not much used in jewelry. The same is true of the white tourmaline. The blue beryl, called aquamarine, is, however, extensively used, also the yellow or golden beryl to a lesser extent. The large beryl crystals are generally opaque and of the characteristic pale apple green color. The tourmalines are found in pockets, but the beryls are usually embedded in the "mineral sheet."

Origin of the Deposits

These pegmatites have been intruded between older metamorphosed rocks. The larger fissures and stocks have been filled with the original granite magma, while in the smaller fissures the magma has become more acid, due to the greater ease with which vapors and superheated steam traversed these narrow openings. These vapors consisted of fluorides and borides of silicon, volatile compounds of iron, manganese, and the alkalies, with superheated steam. By this differentiation, the magma in the smaller openings came to have a greater percentage of gases, vapors, and steam than the original granite magma. Also the larger bodies, cooling more slowly than the small dikes, continued to give off acid vapors which passed, through cooling cracks and open channels in the center, into the smaller dikes as these became partly solidified.

In the smaller of pegmatite masses, the material next the walls was cooled and solidified rapidly as graphic granite. This caused a concentration of the vapors in the center of the dike. These vapors and steam reacting, finally changed borides and fluorides of silicon partly to quartz, which deposited as a secondary coating in the pockets, the hydroboric and hydrofluoric acids combining with the alumina of the feldspar and with lithia to make the gem tourmalines. Later solutions caused the alteration of the tourmalines in some of the cavities to cookeite.

It is seen that this hypothesis, if true, explains why the larger dikes make feld-

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spar mines and the smaller ones gem mines, because in the former there was not sufficient acid vapors concentrated to produce much tourmaline.

Mining Tourmalines at Auburn

The Maine Tourmaline Company's mine at Auburn is situated three miles from the railroad, on the southwestern side of Mount Apatite. An electric car line from Lewiston to Mechanics Falls passes within one-half mile of the workings. The pegmatite outcrops in a meadow and a gentle hill slopes back from the vein to the northeast. The outcrop is a low bluff 5 to 10 ft. high. The dip is 7 deg. to the northeast and the strike is north 50 deg. west (magnetic). Both foot- and hanging-wall are brown mica schists. Two trap dikes, from 4 to 6 ft. wide, standing vertically and striking northeast, cut the vein but have had no effect on the deposit. The upper graphic granite is 4 to 6 ft. thick, the "mineral sheet" is from 2 to 5 ft. thick and the feldspar zone below it is about 2 ft. thick on the average. The lower biotite graphic granite is about 8 ft. thick. All mining, however, stops at the upper edge of this zone at the garnet streak.

The mine is worked by three open cuts, the largest of which is 30x50 ft., with a depth of 14 ft. The rock is broken as follows: a row of 10 to 14 holes from 6 to 10 ft. deep is drilled with a steam drill in the mica schist and graphic granite, and fired by electricity, using 40 per cent. dynamite. This exposes the "mineral sheet" which is taken out carefully with 2- to 4-foot holes loaded very lightly and fired singly by fuses. In case a pocket is approached great care is taken not to place a hole too near where it is supposed to be. The rock next the pocket is removed with a pick or moil.

Approaching a Gem Pocket

The miner knows when he is nearing a pocket by the following changes in the "mineral sheet." First, the albite changes to cleavelandite. Next, a very curious rock composed of quartz and black tourmaline having the structure of graphic granite is encountered. The tourmaline crystals are all parallel plates or lenses and seem to have been stretched while cooling if they were formed from a fluid magma. They are so close to the pocket, however, and the quartz appears so very much as if it were water deposited, that it is likely that both the quartz and tourmaline crystalized from hot acid aqueous vapor and that the surrounding crystallographic relations were such that the tourmaline was forced to crystalize in one plane.

After the black tourmaline and quartz, lepidolite makes its appearance and runs to the pocket. There is often standing over the pocket large plates of muscovite with radial opaque pink or green tourmaline crystals intergrown between the mica plates. The muscovite often changes on its lower edge to lepidolite when the plates extend into the top of the pocket. Sometimes this lepidolite border will go all around the moscovite plate. I observed one diamond-shaped muscovite plate a foot across with a 4-in. rim of lepidolite around it.

Quartz of a smoky hue is generally associated with the large mica plates. The upper half of the cavity itself is generally quartz, mica and cleavelandite, the lower half being a porous decayed potash feldspar. The quartz, mica and cleavelandite growing into the top of the pocket are all beautifully crystalized. Pink and green tourmaline crystals are often grown into these quartz points. Most of the gems, however, lie in the mud or clay which partly fills the lower half of the pocket. Though many crystals are broken or badly flawed, others are perfect.

Many of the pockets contain no gems or apatite and are locally called "dead pockets." When an excessive amount of lepidolite occurs around a pocket it will be found to contain apatite with little or no gem tourmalines. It seems as if all the lithia was consumed by the mica and none left for the gems. In fact black tourmaline in small crystals is sometimes found in these pockets, which would beyond doubt have become gem or lithia tourmaline could they have secured the lithia.

Barren Pockets

The quartz crystals in the gem or apatite pockets are always coated by a thin secondary growth of minute quartz crystals. The quartz crystals of the "dead pockets" have no such coating. This would seem to indicate that the quartz crystals formed first. Then vapors of silicon fluorides, as perhaps the tetrafluoride, and similar vapors and compounds of boron, entered the pocket and meeting superheated steam, were oxidized to silicon oxide, freeing hydrofluoric and boric acids. These acids attacked the feldspar at the lower part of the pocket and with the lithia, which was present or came with the vapors, formed the complex boro-silicate of aluminia and lithia which is gem tourmaline. The latter contains 1.59 per cent. lithia and 0.29 per cent. fluorine, while the black tourmaline contains but a trace of lithia and no fluorine. Also the black tourmaline contains much less alumina and makes up this deficiency by increasing the ferrous oxide from 0.26 per cent. to 14.28 per cent.

In the "dead pockets" the fluoride and boride vapors of silicon never entered and tourmaline was not formed. They are apparently nothing but dead steam cavities, with only bright white or smoky quartz crystals projecting into them from the "mineral sheet" above, and have no secondary coating. The feldspar at the bottom of these pockets does not show the porous structure and decay of that of the gem pockets.

There is another kind of pocket in which the quartz crystals are coated with the secondary growth, but the tourmalines will be mostly altered to cookeite mica, only small portions of large crystals remaining. These cookeite pockets are generally dry or bony, that is, little if any wet mud or clay is present, dry hard cookeite mica taking its place.

A curious thing has been noted at this mine in connection with the gem beryls. A beryl crystal having a black tourmaline crystal next to it or growing into it, is always clearer and of a deep aqua-marine blue and cuts better gems than a beryl crystal not so accompanied. The feldspar from the third zone and all mica whether scrap or plate mica, are saved for market at this mine.

The Maine Tourmaline Company's mine yields principally pink and green tourmaline, the deep red shades not being abundant. Some very beautiful deep green stones of good size have been recovered. In 1904 a series of pockets yielding handsome dark blue tourmalines of nearly an oriental sapphire shade, were opened in pit No. 2. The green tourmalines from the Maine deposits are superior in color and brilliancy, especially at night, to those found in Brazil or California, and when properly cut are exceedingly beautiful gems.

The cost of mining per ton of rock removed for the years 1904 and 1905 was as follows:

Labor, 28.3c.; fuel, 2.3; explosives, 5.9; repairs, renewals, oil, etc., 0.4; total, 36.9. This does not include superintendence or office expenses.

Other Mines

The Pulsifer mine is on the same vein as the Maine Tourmaline Company's property at Mount Apatite. It was opened in 1901 or 1902 and has only been worked in a small way by an open cut about 15 ft. long and 10 ft. wide. This property produced a notable pocket of clear, transparent, purple apatite crystals, of which there were nearly 3000 in the pocket counting all sizes, the largest of which were about 2 in. in length. A large part of this find was purchased by Harvard University and is now in their museum. The occurrence of the tourmaline is the same in this mine as in the mine previously described. The predominating shades are pink and green, and many fine crystals have been taken from this small excavation.

For the last two years the John S. Towne lease has been sublet to the Maine Feldspar Company which did the mining, using a steam drill and derrick to handle the waste, paying a royalty on the feldspar and leaving the gems to Mr. Towne. Green tourmaline of a value of about $1500 was recovered during the

summer of 1907. The deposit is a continuation of the Maine Tourmaline Company's vein, but the dike is much thicker here and contains a greater amount of feldspar. The property is in the class between the straight feldspar mines and the straight gem mines.

The Hatch mine was opened in 1882, near the top of Mount Apatite, on the southeastern slope. The property has been worked spasmodically since. The principal product has been feldspar, the only tourmaline coming from a small open cut where the mine was first opened. The general character of the ledge is similar to those already described except that the dike is very thick. The hanging-wall has been eroded away and the footwall is not exposed to view.

The Berry Mine

The Berry mine, strictly speaking, is not a gem mine, its main product being feldspar. It is situated about two miles south from Mount Apatite. Here cleavelandite is not common, the feldspar being mostly orthoclase. The pegmatite is of immense size and glacial drift hides the wall rocks. It is not possible to tell the shape, dip or strike of the deposit. Both pink and green tourmalines of gem quality are occasionally found. Some good gems have come from the mine, but gem material is not abundant enough to warrant working it as a gem property. Both apatite and herderite are found here. Gem pockets occur in the orthoclase with only a small amount of mica and quartz around them. Lepidolite is always present. The mine has been opened as a large quarry and hand drilling is used entirely.

In the township of Hebron, about 16 miles northwest of Mount Apatite is the Merrill mine. The vein is 12 to 14 ft. wide with mica schist walls. Very little work has been done here. The occurrence is similar to that at Mount Apatite. The deposit has produced some of the deepest red tourmalines I have seen.

The Mount Mica deposit was discovered in 1820 as already mentioned, and the locality is famous for the gems and minerals it has produced. Active mining began in 1880 and has been carried on ever since. Mount Mica is a low hill in the township of Paris, Me., and is 26 miles from Mount Apatite. The pegmatite here is about 20 ft. thick, lying nearly flat between brown mica schist walls. Graphic granite exists next both walls, with the "minerals sheet" and feldspar zone between as at Mount Apatite. The mine is on the top of a gentle hill and is worked as a large open quarry about 200 ft. long by 100 ft. wide by 20 ft. deep at the deepest point. Drilling is done by hand and the waste rock piled behind by a derrick as the quarry advances. One pocket in this mine was of unusually large size, being 6 ft. high, about 12 ft. wide and 20 ft. in length. As is generally the case with very large pockets it contained few gems. The medium sized pockets, 2 to 3 ft. in diameter are the best producers.

The Newry District

The National Paper Company owns a piece of land in Newry, near North Andover, Me., on which tourmalines were found in 1902. The property seems to be fairly rich but due to the peculiar occurrence of the gems, they are difficult to recover. The pegmatite seems to be more or less uniform throughout and lithia minerals, especially triphylite, are abundant. The lepidolite does not segregate around pockets here, but comes sprinkled through the vein in small quantities. The gems occur in the solid rock just as a horablende crystal would in granite, only of course not so abundantly. There are certain spots where the texture of the ledge is coarser and the better gems are found there.

The gem crystals are peculiar in themselves, for they nearly all consist of two crystals crossed obliquely. They are generally opaque and of a faint apple green color on the outside with a beautiful, clear, red or green center. What the form of the deposit is I am unable to say as I obtained my description of the mine from Loren B. Merrill, manager of the Mt. Mica mine. This Newry deposit is about 70 miles from Mount Apatite, in a northwesterly direction and is on the end of the belt, as far as has been proved.

Metallic Chromium

Although chromium has long been known, it was not until the advent of the electric furnace that it was produced in a solid mass. Previous to that time it was obtained only in powder or fine crystals. According to the *Brass World*, May, 1909, solid, massive chromium is now obtained commercially in two ways: (1) By the so-called aluminothermic method; (2) by means of the electric furnace.

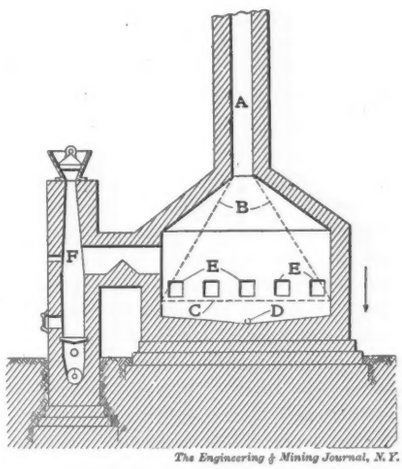
The aluminothermic process consists in reducing the oxide of chromium by means of aluminum. The reaction which takes place supplies heat enough to melt the chromium. By adjusting the proportion of oxide of chromium and aluminum it is possible to obtain fused, metallic chromium of high purity by this process. It is free from carbon.

In the electric furnace process, oxide of chromium is heated with carbon by means of the electric arc and the chromium is then reduced to the metallic state. When thus made it is combined with a large percentage of carbon, and requires purification. To remove the carbon, the crude chromium is melted with lime in an electric furnace. The carbon combines with the calcium to form calcium carbide; and the pure chromium is obtained as a fused mass.

By either of these processes, it is possible to obtain fused, massive chromium of a purity of from 97 to 98 per cent. metallic chromium. It does, therefore, compare favorably in purity with ordinary commercial metals.

Jones Iron Furnace

In U. S. Pat. 12,928, March 16, 1909, assigned to the Jones Step-Process Company, John T. Jones, of Iron Mountain, Mich., illustrates an improved furnace similar to that previously patented by him (U. S. Pat. 866,280, Sept. 17, 1907). The furnace is designed for smelting iron ore containing slag-making constituents which become fluid at a temperature not exceeding 2300 deg. F., a lower temperature than is necessary to melt the reduced iron of the ore. A vertical sectional elevation of the furnace is shown in the accompanying illustration in which the upper portion of the ore stack is broken away. The furnace consists essentially of a separate fuel-burning furnace *F* and an ore stack *A* with a chamber beneath the latter for the separation of the unmelted material and the molten slag.



JONES IRON FURNACE

The stack *A* is charged with ore in a finely pulverized condition mixed with a refractory material such as coke. The charge spreads out at the base of the stack as indicated by the dotted lines *B*. The reducing gases from the furnace pass around and through the ore column reducing the iron oxide to metal, the molten slag accumulating as a bath in the bottom of the chamber. When it has reached a depth indicated by the horizontal dotted line *C*, it is tapped off through the slag hole *D*. At *E* are horizontally operated rams which force the unmelted material through discharge openings on the opposite side. The metal is then separated by crushing and concentrating, or otherwise.

Features of a Vein Formation in Nicaragua

The Vein-System and Orebodies Appear to Be the Result of the Fracture and Decomposition of Effusive Rocks, Their Tuffs and Breccias

BY H. E. WEST*

The purport of this paper is to portray the typical features of a vein system situated in the Matagalpa district of Nicaragua. The explanation offered makes no pretense to being authoritative; on the contrary, it is a simple record of observations such as are necessary to the intelligent exploitation of any ore deposit. From the general topography of the locality it is apparent that the structural geology is a manifest of its volcanic nature. This inference is supported by: (1) The abruptly broken topography of the entire area; (2) the effusive overflows exposed on the high summits, mostly basalt tuffs, and breccias; (3) the rhyolite sheet in the low ground, with its several conical hills (this sheet has a strike almost east and west, and extends for several miles); (4) the andesitic-breccia south of the vein, with amygdaloidal sheets, andesite or possibly diabase.

In brief, the entire region, with an altitude of 2000 to 3000 ft. above sea-level, is composed exclusively of volcanic ejectamenta and lava flows. It would appear as if, for the most part, the central and western portion of Nicaragua, at surface, were composed of extrusive rocks. The deep-seated granite, diorite, and allied rocks, are absent, although possibly occurring and visible outside the influence of the more recent outflows. Sedimentary rocks appear to be entirely absent, although, some distance from the mine, there are said to occur small deposits of limestone.

Central America generally is noted for its products of vulcanism, and possesses several active volcanoes. In Nicaragua there may be half a dozen volcanoes still active, of which Momotombo, near lake Managua, is the most active. After enjoying a period of ten years of comparative quiet, during 1904 this mountain was the scene of a very active eruption. Bombs were hurled, it is claimed, thousands of feet in the air; dust settled on the neighboring cities, while streams of lava flowed to the base. The detonations from the crater were plainly heard in Matagalpa, a distance of 90 miles.

Vein Matter

Speaking generally, the valuable part of the vein consists of bands of vesicular quartz with a filling of soft manganese oxide and clay. The width of this material varies from a foot to posbily 20 ft. in places, having an average thickness of 3 to 4 ft. Bordering this on one or both sides, is often a brecciated wall-rock, cemented by quartz; which quartz, usually in crystalline form, radially surrounds the inclosed fragments. This friction breccia is often drusy and contains many beautiful quartz-lined vugs. The brecciated portion is invariably of low grade. From the open nature and porous structure of the vein, there is, as might be expected, a free circulation of groundwater; which accounts for the thorough oxidation and for the presence of a quantity of a red unctuous clay, occurring as a "gouge" against the walls, and also filling joints and interstices.

Outside the zone of brecciated wall-rock, as shown in Fig. 1, there extend in some instances, what might be termed "quartz-droppers," having a dip of about 60 deg. These droppers enrich the country, but rarely enough to make the rock profitable to mine.

A noteworthy feature is the presence of a blue-green rock, very hard and tough, usually impregnated with pyrite, and to a certain extent with zinc and lead sulphides. This rock, which has the appearance of being formed from fragments filling a fissure, cemented and hardened by silicious waters, may, therefore, be termed a clastic or fragmental dike, and I shall so designate it. This occurrence is found on the footwall side of the manganese section, and immediately contiguous to that part of the vein. The dike is never very wide; it varies from a few inches to 4 ft. It is strongly in evidence as far as 1300 ft. in adit No. 1, where it leads to a wide lens of ore; for the entire distance its presence is associated with the enrichment of the vein. Thence to the present end, almost 2000 ft. to the breast, this dike alters materially, and, in places, is not even apparent. It loses its distinctive color and is more open in texture, but it is still plainly fragmental; chert, with pyrolusite and psilomelane are marked associates. Coincident with this change is an impoverishment of the vein.

In Fig. 3 are shown sections of adit No. 1 at 620, 900 and 1850 ft. respectively. The view at the left is a normal exposure of the vein in the breast at the western end; in this, the dike, the vesicular quartz-bands and the included

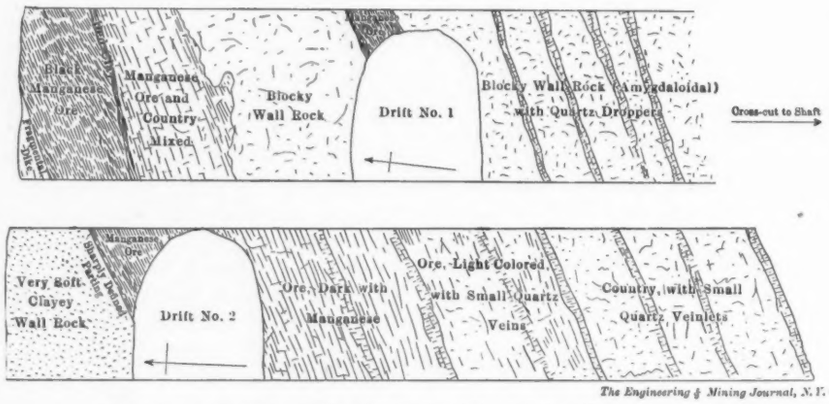

Black Manganese Ore
Manganese Ore and Country Mixed
Blocky Wall Rock
Drift No. 1
Blocky Wall Rock (Amygdaloidal) with Quartz Droppers
Cross-cut to Shaft
Very Soft Clayey Wall Rock
Manganese Ore
Drift No. 2
Ore, Dark with Manganese
Ore, Light Colored with Small Quartz Veins
Country, with Small Quartz Veinlets
The Engineering & Mining Journal, N.Y.

FIG. 1. SECTIONS AT CROSSCUTS IN ADIT NO. 1 AND ADIT NO. 2

manganese ore are plainly shown. The soft north wall and the shaly hanging are also typical. In the center view the hard firm footwall is the clastic dike, while the hanging is shown extremely broken, an evidence of its weak, slabby nature. The roof is composed of the volcanic breccia, which is here remarkable for the brilliance of its coloring. The blue of crysocolla, the green of malachite, the brick-red of iron peroxide are mingled with the lighter shades of mauve, pink and yellow, and scattered through the mass are fragments almost pure white, usually roughly rectangular in section. Some of the constituents, such as the light-blue rock, are in masses 3 to 4 in. in diameter; but, for the most part, the fragments are small, usually from ¼ to ½ in. in diameter. Toward the eastern end of the adit the clastic dike gives place to a more coarsely

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fragmental rock, in which particles of chert are prominent; and, in addition some of the harder forms of manganese oxide, such as psilomelane, the hydrated oxide (with its conchoidal fracture) and also pyrolusite (of fibrous texture), and probably some manganite.

Enrichment of the Country Rock

An interesting example of the alteration of wall-rock to ore, either by replacement or impregnation, is shown in Fig. 2. Here we have the direct conversion of practically barren country with gold to the amount of 20c. per ton, being enriched to ore of $5.20; the physical appearance is changed, as also its chemical composition, in part due to the deposition of manganese oxide. Probably impregnation rather than molecular replacement, would be the more justifiable interpretation. The occurrence of small unaltered cores is interesting, showing

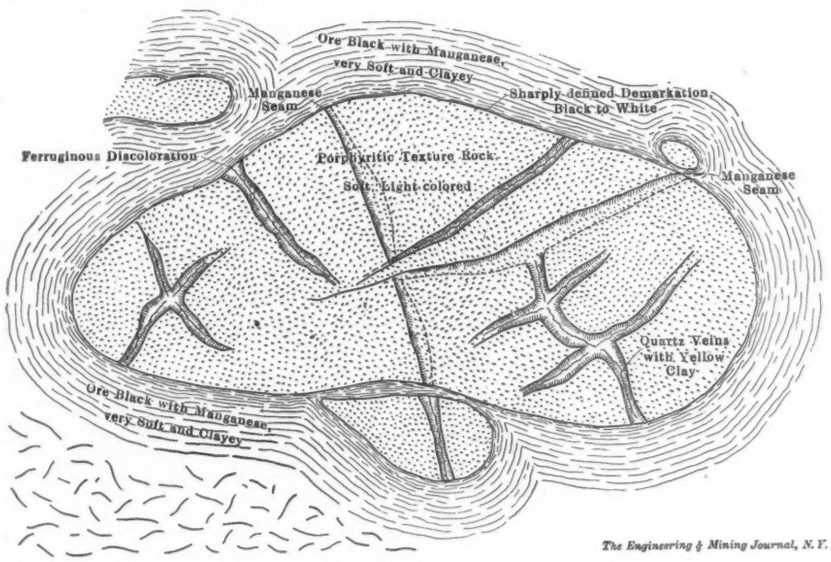

Ore Black with Manganese, very Soft and Clayey
Manganese Seam
Sharply defined Demarkation, Black to White
Ferruginous Discoloration
Porphyritic Texture Rock, Soft, Light colored
Manganese Seam
Quartz Veins with Yellow Clay
Ore Black with Manganese, very Soft and Clayey
The Engineering & Mining Journal, N. Y.

FIG. 2. ALTERATION OF WALL ROCK TO ORE BY FISSURING, SILICA INFILTRATION AND MANGANESE IMPREGNATION

how some of the wall-rock has resisted the encroachment of the circulating manganese-charged waters.

It would also appear as if, previous to the impregnation by manganese-bearing solutions, the wall-rock had been rent and subsequently filled with quartz, crystallizing out of deep-seated waters. These solutions were presumably low in manganese, as the quartz-filled fissures in the wall-rock usually contain but a filling of yellow clay, the alteration products of the feldspars. Fractures, possibly of another period from those forming the quartz veinlets, bearing manganese on their exposed faces, afford support to the hypothesis suggested.

At the left in Fig. 4, the roof of adit No. 2 presents a representative structure; there is the soft black wad on each side, with brecciated wall-rock cemented by quartz, and manganese oxide with included country. On the right in Fig. 4 is shown a sketch of the crosscut in the south wall, inside of a vein enlargement. This inner section contains but 80c. per ton in gold, and is, therefore, but slightly enriched; and it is plainly evident that this enrichment is due to the veinlets filling numerous fractures that seem to conform roughly with the large joint planes of the basaltic country. The arrows show that these slips cross one another, forming blocks. It would appear as if this were one of the earlier stages of ore formation following the first steps of decomposition along the joint planes. On the other hand, as the orebody seems to favor the softer breccia, by the alteration of which most of the ore appears to be formed, it is equally possible that this may be read as an example of the definition of the orebody, the basalts not favoring metamorphism to ore.

Referring again to the section of the roof shown in Fig. 4, the gold and silver occurrence is noteworthy; here, again, the richest ore occurs in the dark manganese, the brecciated section being practically barren, and the included wall-rock carrying but a trace of either metal. The breast of adit No. 1, at 620 ft., in Fig. 3, is typical of a section showing some of the higher gold contents. This is usually the case when the vein has a banded structure with included manganese. It will be noted that the clastic dike is poor.

Distribution of the Metal

From several experiments, I concluded that the gold is more intimately associated with the quartz, and the silver with the manganese. A sample was panned, washing off the manganese and clay, and the concentrate assayed. The results tend to confirm the assumption that the gold content is confined largely to the environment of the quartz, and the silver to the manganese portion. The occurrence of gold is mostly free, although very fine and rarely visible. The gold particles are, however, not readily amalgamated, owing probably to an enveloping film at present unascertained. There would appear to be evidence of a thin quartz seam comparatively rich in gold, and, at times, in native silver, passing through the richer portions of the vein.

There is a marked decrease in the silver content of the manganese ore in the eastern part of the mine. The gold content is more pronounced and the orebody wider when the vein passes through the soft porphyritic country, presumably a softened and altered andesite, which accompanies the vein from about the 600-ft. to the 1600-ft. mark. From this point east within the harder basaltic country the vein is both smaller and poorer; so that, generally speaking, the low parts of the contour may be regarded as more favorable to ore formation.

Another marked feature is the large amount of clay, the work of the groundwater on the soluble silicates of the vein walls. This clay is usually of a banded and fissile structure, often red and black alternating, so that when sun-dried, the mass falls to pieces with a distinctly conchoidal fracture, resembling the leaves of a crumpled book. A sample was dried and assayed, it gave $2.40 in gold and no silver. Generally speaking, the ratio of silver to gold in the deposit is as 1 to 10, allowing 50c. per oz. of silver.

Mode of Ore Genesis

It would appear that we have to account for one or more rock fractures; wall brecciation; a fragmental filling; silicification; and contemporaneous or subsequent impregnation by manganese, with gold and silver enrichments. Doubtless, the volcanic nature of the entire formation will satisfactorily account for the agency producing the primary rock fracture and wall brecciation, and also for any subsequent fracture and its filling with rock fragments.

The comminution of the rock faces by subsequent movements would account for the wider breccias; also the coursing through of deep-seated silicious thermal waters, which, in cooling, formed the cementing medium of this breccia. The latter breccia is very distinct from the silicified fragmental filling previously mentioned. The latter has an open texture and is full of vugs; the quartz, moreover, is crystalline and arranged

radially to the inclosed fragments; whereas the former is a dense, hard, blue-green rock, with the fragmental portions often all but undiscernible, and usually impregnated with metallic sulphides. Through the more open channels, due to the suggested secondary rock movement, there would appear to have been introduced circulating waters rich in manganese, the clastic dike to the north forming both an impenetrable barrier and acting as a guide to the manganese-enriching waters.

The question arises, whence came these large quantities of manganese oxide? It would appear in the first instance, that in the volcanic countries comprising Central America, there exist quantities of manganese; as, for instance, the northern part of the Isthmus of Panama. Possibly volcanism and an extensive circulation of acidic meteoric waters have a direct connection with the formation of manganese deposits. In many of the volcanic rocks of this region manganese is present, mostly combined as a silicate, but probably originally also as an oxide; and it is possible that the groundwater circulation in these tropical countries may act both as a solvent and collector of these manganese compounds.

The effusive rocks are, moreover, extremely permeable, and therefore the water circulation may be taken for granted as being both vigorous and comprehensive. Professor Kemp says, "In regions of expiring volcanic activity, waters may be expected at comparatively any reasonable depth and, therefore, comprehensive circulation of deep-seated waters may be expected;" and again in regard to sources whence circulating waters derive the elements of ores and gangue, "The generally accepted theory is that they are gathered from a condition of extremely lean dissemination in the rocks through which the underground waters migrate, and the contents leached out." We have, therefore, conditions favorable to a considerable circulation of waters, active in the deposition of ores and their gangues.

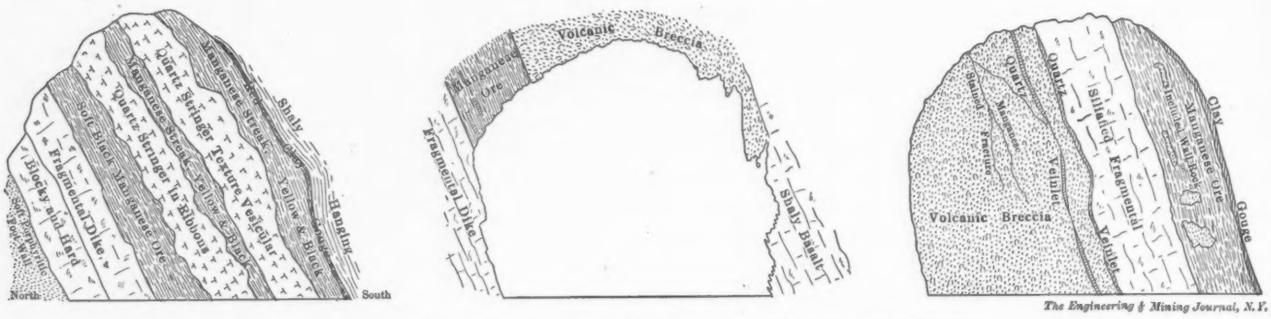


FIG. 3. SECTIONS ON ADIT NO. 1 AT 620, 900 AND 1850 FEET, RESPECTIVELY

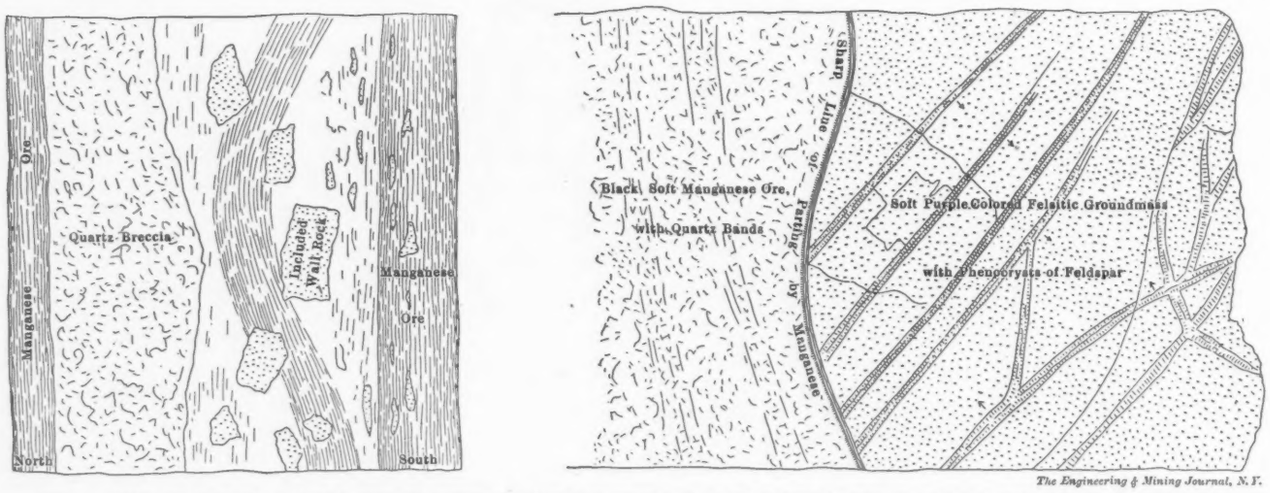


FIG. 4. ROOF OF ADIT NO. 2 AND CROSSCUT SHOWING TABULAR JOINTING WITH INFILTRATION OF QUARTZ BUT VOID OF MANGANESE

Source of the Manganese

Presumably the presence of the manganese in its present form of oxide is, for the most part, an alteration from its original state as an accessory mineral in the volcanic rocks, in some such form as in the iron, calcium, zinc and manganese silicates. Manganese deposition appears to have many features similar to those of iron; and it is probable that for both, immense as are the proportions they at times assume, these deposits are in the first place gathered from the complex silicates that are components of volcanic rocks. These minerals are soluble in both mineral and humus acids, such as occur in acidulated meteoric waters containing traces of sulphuric and carbonic acid; and probably are first altered to the carbonate, thence to the hydrous oxide whence is derived the dehydrated form, as in hematite and pyrolusite. With regard to their sulphides, those of iron are of common occurrence, as pyrite, marcasite and pyrrhotite, while the manganese sulphide, alabandite, is somewhat rare, and, therefore, cannot be accepted as a source of any considerable quantity of manganese deposition. The presence of wad can doubtless be accepted as an alteration, in respect to its physical characteristics, from the harder hydrous oxides, manganite and psilomelane. Neither rhodonite, the silicate, nor rhodochrosite, the carbonate, has been observed, and it would not appear as if rhodonite, the meta-silicate, were the primary form of the manganese.

Passing in brief review we have the following features characterizing this deposit: (1) The entire geological construction of the vein system composed

of effusive rocks, their tuffs and breccias; (2) earth movements with crushing of rock-faces, followed by silicification, forming quartz breccias; (3) a hard blue-green silicified fragmental, that almost invariably accompanies the manganese portion of the lode and its position on the north wall; (4) the presence of an unusually soft manganese filling with vesicular quartz bands comprising the ore of economic importance; (5) masses of red unctuous clay, the resultant decomposition of the feldspars and other soluble silicates, and affording evidence of the easily destructible nature of the basic eruptive rocks; (6) the association of the vein, for the most part, with a sheet of andesite breccia, at times thin, but of varying width, which breccia would appear to have formed (by impregnation and alteration) the larger bodies of ore; (7) the noticeable enlargement of the vein when passing through the soft and porous andesite, and its contraction and impoverishment in the more basic rocks, which from their close texture would not appear favorable to the passage of solutions for any distance into the inclosing walls although the vein itself be sharply defined: (8) and last, when the vein following the softer breccia is inclosed by basaltic rocks, the conditions are not as favorable to the formation of ore as when the breccia is incased by walls of porphyritic texture, usually andesite.

Australasian Mineral Leasing*

By A. C. Veatch†

The recent mining enactments of all the Australasian states regardless of political complexion, are based on the policy of mineral leasehold. Not only do all the political parties of Australia today heartily indorse this policy, but it represents a gradual evolution from the principle of freehold, through stages varying somewhat in different states.

The mining laws of all these states require continuous development, the enforcement of which is incompatible with the state of freehold. Development as a condition of possession was early recognized in mining practice in the United States; but the annual assessment work required by the present mining law fails to accomplish the continuous development which is requisite to a proper utilization of the mineral resources of the country. On this account the consideration of the extent to which the leasing policy succeeds in securing such development becomes of vital interest.

*An address delivered before the Conservation Commission, Dec. 3, 1908. Published with the permission of the director of the U. S. Geological Survey.

†Of the U. S. Geological Survey, Washington, D. C.

Western Australia

In Western Australia the development of the mineral land laws has been particularly simple. At the time of the first mineral discoveries in 1842, mineral lands were sold under the same conditions as agricultural lands. Later the purchase price was fixed and the option of lease provided. In 1872-73 the erection of a satisfactory mining plant was made a prerequisite to purchase of the land and the rate of lease rent was reduced. Then, after the gold finds of 1885, the abandonment of the principle of sale became a state policy, and in 1898 provision was made that land grants should contain a reservation of all minerals. Thus, in Western Australia the system of leasehold and claim-hold on the conditions of *bona fide* development came at a time most opportune for the test of practice. For the five years comprising 1881-1885 the average annual mineral production was less than £9000, while for the past five years the annual output has exceeded, £8,000,000. Not only was the law subjected to this practical test of great expansion in the mining industry, but an investigation by a commission on mining showed that throughout the goldfields the verdict was overwhelmingly in favor of leasing.

The same general satisfaction with the leasing system is found in the Collie coalfields, although the coal operations are not comparable with the gold mining. The coal-land law has promoted the development of the industry in this field, which is not so favored by natural conditions as most of the American coal lands. The provisions of this law encourage prospectors by granting exclusive prospecting rights over a considerable area for a limited period, followed by either reward or ordinary leases when discovery has been made. Continuous development is secured by the terms of the lease. The decision was reached in Western Australia that 2560 acres is a sufficient maximum for a single holding, except where the coal seam is at a depth of over 1000 ft., in which case 5120 acres is allowed, a decision which is in striking accord with the opinion independently reached in this country and embodied in one of the coal-land bills recently presented in Congress.

The Western Australian mining law is, in short, a wonderfully symmetrical and carefully balanced enactment, and while it may not be, as a whole, applicable to American conditions, it contains many suggestive provisions which merit careful consideration, as they are not the idle vision of some theorist, but the mature enactment of a legislature whose members are chosen entirely by the voters of a great democratic mining state, a state which ranks among the greatest mining countries of the world and which as recently as 1904 has reorganized and revised its mining laws to meet the practical work-a-day conditions of a mining region.

The mining law of Western Australia is that of a state in which the mining industry is of preëminent importance. The mineral exports of the country are from five to six times the real value of all other exports. It is, moreover, a mining community in which the capital employed in development is almost wholly of foreign origin. On these accounts the evidence furnished by the development of mining laws in South Australia is to a large degree supplementary to that afforded by Western Australia.

South Australia

South Australia is a country in which mining occupies the subordinate position, the mineral exports amounting to less than one-tenth the value of the other exports, so that the mining law is that of the agricultural holder and local capitalist.

In South Australia the alienation of

TABLE I. SUMMARY OF HISTORY OF GOVERNMENT MINERAL LEASING IN AUSTRALASIA.

By A. C. Veatch.

	Year of First Government Leases for			Year in Which Sale of Known Mineral Land Was Practically Abandoned.	Year of First Reservation of All Minerals.	Total Area Held Under Mineral Lease in 1905.[d]	Total Value of Mineral Production in 1905.	Percentage of Total Production From Government Leasehold.
	Gold.	Minerals Other Than Coal and Gold.	Coal.					
Western Australia	1886	1865	1896	1886	1898	56,541	8,555,841	96
South Australia	1869	1854	1874	1872	1888	27,157	568,796	90±
Tasmania	1860	1862[a]	1853[b] 1862[a]	1859	1903	52,924	1,729,129	100
Victoria	1857	1861	1853–4[b] 1862	1860	1892	84,546	3,361,455	93
New South Wales	1851	1856	1861	1884	1884	173,342	7,017,940	68
Queensland	1868?	1872	1891	1882	No reservations except in gold and mineral fields	38,874	3,726,275	91
New Zealand	1858	1852	1852	1875[c]	No reservations.	149,697	3,622,786	90±

[a]Date of act; date of first lease unknown, but soon after date given.
[b]Special leases.
[c]Isolated case; practically no known mineral land has been sold in New Zealand since 1850.
[d]A considerable area is also held under mining claims, or as prospecting areas.

minerals has been carried further even than in the United States, yet here too, the principle of leasehold has developed and been fully tested. The history of the mining law of this country becomes of special interest to Americans, as it shows the practicability of introducing a system of government leasehold after important mining properties have passed into private ownership.

There has resulted a surprising unanimity of opinion in favor of government leaseholds for all minerals. Mining engineers, operators, and capitalists unite in asserting that mining development is promoted more by leasehold than by freehold. The leaders of the several political parties agree that the matter of government leasehold is not a party question. It is important to note that the mining laws of both Western Australia and South Australia vere developed under Conservative or Tory governments, and while a Labor government has been in power for some years in South Australia, these mining laws cannot be characterized as "radical labor legislation." They are, in fact, nonpartisan enactments which antedate the present supremacy of the Labor party.

Victoria

In Victoria the national mining law has been enacted under conditions strikingly like those under which the American mining law developed, but with very different results. Here, as in California, there was, at the time of the discovery of gold, no law governing mining on the public lands. In both countries the discovery of valuable goldfields resulted in an enormous immediate influx of population and while the United States delayed dealing with the situation the Victorian government attacked the problem at once and by the time of the passage of the American Act of 1866 had evolved a very comprehensive mining law. In Victoria the development of the coal resources has been practically all under government leases notwithstanding the fact that considerable areas of coal land are in private ownership.

Tasmania

The mining law of Tasmania has been commended in the Australian mining press as the model among the Australian laws from the standpoint of the capitalist. This state was the first to provide that no lease should be forfeited for non-compliance with the development conditions during suspensions of work due to strikes. The last mining act also meets the demands of investors for more secure tenure by providing for the expression of the development covenant in money instead of men and by allowing, under certain restrictions, the excess of development expenditure in one year as a credit on the requirements of the next. In Tasmania, at the time of the early discovery of coal under the existing policy of alienation of lands the coal lands passed into private ownership. Yet, today all the working coal mines are reported as operating under government leasehold, showing that the terms of leasing must have proved satisfactory. The present act permits consolidation of leases to any extent in the discretion of the Minister of Mining.

New South Wales is the most important of the Australian states from the standpoint of its coal production. In this state there is the same general indorsement of mineral leasehold; indeed it may be said that there is absolutely no demand for private ownership of minerals. The history of government leasing in Australasia and the tenure and conditions under which leases are today issued in the various states are summarized in the accompanying tables.

In the Bennington group of mines at Iron mountain, Shasta county, owned by the Mount Shasta Gold Mining and Milling Company, there has been encountered at a depth of 100 ft. a 6-ft. ledge carrying the same high values as those found on the surface during the last four or five years. A 1600-ft. crosscut tunnel has been run with its mouth on a level with the Iron Mountain railroad, and it is in this tunnel that the ledge has been found.

TABLE II. TERMS AND CONDITIONS UNDER WHICH MINERALS ARE TODAY LEASED IN AUSTRALASIA.

	Western Australia.	South Australia.	Tasmania.	Victoria.	New South Wales.	Queensland.	New Zealand.
Term of years:							
For gold	21	42	21	15	20	21	42
For minerals other than gold and coal							42–62
For coal							66
For dredging	21	10					
Maximum area in acres:							
For gold	24	20	40	no limit	25	50	100
For minerals other than gold and coal	48	40	80	640	80	160	320–1000
For coal	320	640	320	640	640	320	2000
For dredging	5000	200			100		
Rent per acre per year:							
For gold	£1	1s.	£1	2s. 6d.	5s.	£1	7s. 6d.
For minerals other than gold and coal	5s.	1s.	5s.	1s. to £1	5s.	10s.	2s. 6d.
For coal	6d.	1s.	2s. 6d.	1s. to £1	1s.	6d.	1s. to 5s.
For dredging	6d.	1s.			2s. 6d.		
Royalty:							
For gold (per ounce)	none				none	none	2s. [c]
For minerals other than gold and coal	none	2½%	[a]	none	none	none	½%
For coal per ton	3d. first 10 yr., 6d. thereafter.				3d. to 6d. per ton.	[b] 3d. first 10 yr., 6d. th'after	2d. to 1s.
For dredging	1s. per oz.	none			1%		
Development conditions, expressed in men per acre per year:							
For gold	½	½	none	Fixed by minister	½	½	½ to ½
For minerals other than gold and coal	½	1/10			1/10	1/10	1/25 to 1/25
For coal	1/50	1/10			1/100	1/10	
For dredging	none	1/10			1/100		
Development conditions, expressed in money per acre per year:							
For gold	Must be labor	Must be labor	£10	Fixed by minister	Must be labor	Must be labor	
For minerals other than gold and coal			£2				
For coal			£2				
For dredging	30s.	£20			£10		

[a] Such as may be fixed by regulation. None has been charged up to this time. [b] Rent a credit on royalty. [c] Only in North Island.

A strike of gold quartz has been made in the San Carpajaro section above San Simeon landing, on the border line of Monterey and San Luis Obispo counties, Cal., the mine being actually in the former county. A 7-ft. ledge carrying free gold has been found in the old Cruikshank mine which was worked for a time some 20 years ago, but has been abandoned for a long period. The mine is in the Coast Range, and nearly on the coast line, where it was thought gold would not be found. Now high-grade ore has been found at the depth of 50 ft. It is probably another pocket such as was found years ago but the presence of the gold upsets some theories as to the nonexistence of gold deposits in the Coast Range of California.

A Model Coal Mine in Westphalia

The Company Works 15 Seams, Varying in Thickness from 1 1-2 to 10 Ft. Each Bed Is Worked Retreating, and Product Is Carefully Washed

BY WILLIAM S. HALL*

The Zollern II colliery, which is described in this article, is one of the most extensive of several large collieries operated by the Gelsenkirschener Bergwerks-Actien Gesellschaft, and is situated at Merklinde near Gelsenkirchen in Westphalia. The great Westphalian coalfield lies on the west shore of the Rhine. On every side in this region are evidences of great industrial development. Essen with its immense Krupp works is in this district, and at Gelsenkirchen, Dortmund, Bochum, Herne and other large towns are numerous and varied industries with extensive plants. In 1906, 36,000,000 tons of lignite and 130,000,000 tons of bituminous coal were mined in this district. Most of the coal-mining companies are formed into a syndicate which controls about 90 per cent. of the production.

Many of the seams are thin, some are quite dirty, and at places they are highly inclined. One of the first things that strongly impresses an American is the lavish expenditure on the surface plants. The buildings are substantial, fine looking structures, always built of brick or stone, and the machinery equipment is superior. A washery is connected with nearly every colliery and sometimes the entire output goes through the washery. The finest culm coal is saved and is coked, or made into briquets on the premises.

Machinery Hall

Fig. 1 is a view at Zollern II, showing the administration building with the offices in the center, with a well kept lawn, trees and flower beds in front and a shaft with a group of mine buildings on each side. Machinery hall is one of the most imposing of the buildings. It is commodious, well lighted, with high ceiling, tiled floor, frescoed walls and stained-glass windows. The floor and machinery are kept scrupulously clean. Aside from its convenient appointments as a central power station, this structure architecturally and in ornamentation is veritably a thing of beauty. The main power plant consists of three triple-expansion horizontal steam engines, directly coupled to direct-connected dynamos. The engines make 90 r.p.m. with 1500 normal h.p. and 1950 maximum h.p., generating a current of 500 volts with 1100 normal kw. and 1450 maximum kw.. These machines generate current for the whole plant.

There are two electrically driven air compressors, providing 2300 cu.ft. of air per min. at 130 lb. pressure. The building also contains the winding engines and other machinery. In a detached building at one end of machinery hall are three banks of Babcock & Wilcox boilers with four boilers in each bank. These are heated by gas from the coke ovens.

Hoisting

There are two shafts similarly equipped and located about 250 ft. apart, as shown by the headframes in Fig. 1. Each headframe is constructed of steel and is given great strength and rigidity. The headframe is supported on heavy concrete foundations and is covered by a sheet-iron bonnet or hood.

The winding engines were built by Siemens & Halske. Each engine is a 350-h.p. machine, and is driven by a direct-current motor on each side of a 12-ft. steel flywheel weighing 40 tons. Ilgner's compensator or equalizer is a feature of the winding mechanism. The Koepe system of hoisting is employed.

The shafts are round, 18 ft. in diameter, 1000 ft. deep, and are walled with bricks. One shaft is used for hoisting and the other ordinarily serves only for ventilation, but is equipped so that it can be employed at any time for hoisting. The cages have four decks, each deck carrying two cars tandem. The flat rope has a cross-section of 2x8 in. Forty-six men are hoisted in a cage at one time. Hoisting continues for 15 hours each day and the daily output is 2000 tons.

Exploitation

The company operating Zollern II works as many as 15 seams in some of its collieries. These seams vary from 1½ ft. up to 10 ft. in thickness. The beds at Zollern II are moderately flat, the dip varying from 3 to 32 deg. Each bed is worked retreating toward the shaft and the seams are mined in regular order from the surface downward. The work is advanced with such uniformity that all the working faces form an outline that is approximately elliptical.

The method of exploitation varies with the conditions. One method is illustrated in Fig. 2. First the rectangular pillars *a a* are worked out simultaneously. Then the open square spaces are enlarged by working out the parts marked *b b*. Afterward the portions marked *c* and *d* are started, *c* being driven from both ends to meet in the middle. When *c* is well advanced, the next slice *e* is started at both ends. This method is sometimes varied by finishing each slice or strip before starting another.

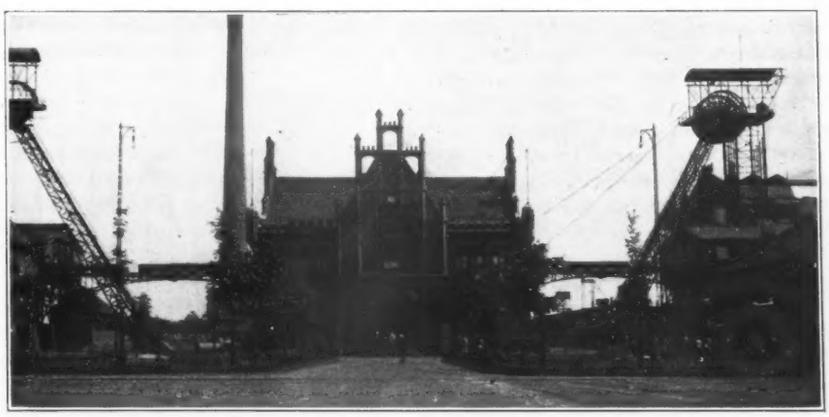


FIG. 1. A GENERAL VIEW OF OFFICE BUILDING AND SHAFT HEADFRAMES AT ZOLLERN NO. II MINE

Another method of exploiting the seam is illustrated by Fig. 3. This method is so apparent from the sketch as to require no further explanation. Two men work together in one of the rooms shown in Fig. 3.

Most of the mine timber is creosoted. A gangway timber set is made of two oak legs, each having a wrought-iron strap around the top to prevent splitting, and an iron I-beam for the collar. An iron angle bracket connects the collar with the leg on each side. The main haulage roads, especially near the shaft, are heavily lined with masonry. Side walls are sometimes substituted for the oak legs of the timber sets. Wooden headers are built into the walls so that a certain amount of yielding under the roof pressure may be provided for. Large regular flat stones are used

*Professor of mining in Lafayette College, Easton, Penn.

to face the side walls, while the back is filled in with smaller stones. Wooden partitions are built to retain the culm that is flushed in to fill the worked-out chambers, and these remain in position until the material solidifies. Thus all the open spaces are filled up as soon as possible after they are vacated and the surface is not permitted to settle. In this way mining proceeds under the town without disturbing the buildings on the surface.

Iron props designed to telescope, without injury to the props when the pressure on one exceeds 15 tons, are much used in the rooms. There is but little water in the mine, all of which is drained to one sump in the deepest part and pumped to the surface in one lift.

Underground Haulage

Three systems of underground haulage are in use; rope, electric and animal haulage. The relative costs of these are as 1, 3 and 9 respectively. Endless-rope haulage and electric locomotives are used on main roads and horses are employed in the secondary haulage. The bodies of the cars are made of sheet iron with curved bottoms. The dimensions of a car are 5½x2½x4 ft., and it holds 8 tons. The car wheels are fixed on the axles, the journals are self oiling and are provided with ball bearings. The wheel base is 18 inches. The rails are unusually heavy for the small light cars. Switches are operated automatically so far as possible, and the air doors are opened by the moving trains and closed by springs or gravity. One endless rope haulage line is over a mile in length.

Each electric locomotive is run by a 4-h.p. storage battery and replaces 30 horses. The locomotive runs at a speed of 13 ft. per sec. hauling 30 loaded cars weighing about three-fourths of a ton each. Each engine has two motors in series or parallel. At the charging station, the locomotive is brought into position between two concrete piers, the tops of which are on the same level as the car platform on which the storage battery rests. In changing the batteries, the battery on the truck is pushed laterally on runners to the pier on one side, and the charged battery from the pier on the other side is substituted.

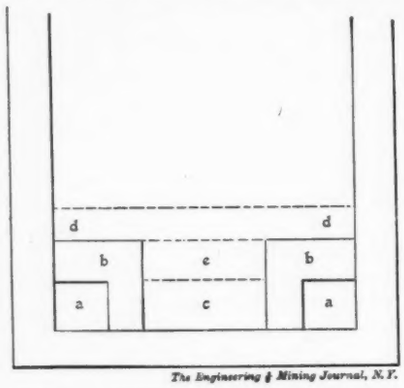
Washery

The washery is of the type in which the coal is classified at the top before being passed through the washery. The plant was installed by Schuchtmann & Kremer, of Dortmund. The cars are run directly from the cage platform into revolving tipples and are dumped, the coal passing down over an inclined screen which has a back and forward motion. The over-sizes go to a moving sheet-iron picking belt, while the through sizes are elevated to the top of the washery, where they are classified and the different sizes are run to different jigs.

The sizing is done in four trommels having two divisions with different screen meshes in each trommel. The meshes of the first are 1.5 and 3 in.; second, 0.8 and 1.5 in.; third, 0.4 and 0.8 in.; fourth, 0.15 and 0.4 inches.

The slimes pass into large concrete settling chambers and the water after settling is pumped back and used over again. After the fine coal is drained off until it is sufficiently dry, which requires about 6 hours, it is sent to the coke ovens. The dirt is flushed into the mine. Running water carries the different sizes of coal to storage pockets placed above railroad tracks.

The capacity of the washer is 2000 tons



The Engineering & Mining Journal, N.Y.

FIG. 2. A COMMON METHOD OF EXPLOITING THE SEAM

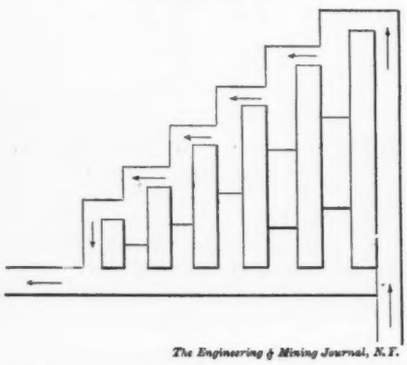


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FIG. 3. A GENERAL ROOM-AND-PILLAR SCHEME OF DEVELOPMENT

in 24 hours. 3300 gal. of water per minute are required. The proportion of water to coal is about 1 to 3. There is approximately 10 per cent. of rock in the coal as it comes from the mine. The coke contains from 5 to 6 per cent. of ash. The coke ovens are close to the washery and an improved by-product recovery plant is installed.

Ventilation

The ventilation is effected by two Rateau fans. These are electrically driven and give 210,000 cu.ft. of air at 192 r.p.m. Air-test stations are located in various parts of the mine, where the temperature and the amount of air passing are periodically measured and samples of air are taken for gas analysis. The results of these investigations are conspicuously posted at each station. The anemometer used is a self registering one, and runs for ¼ of a minute before beginning to register, and records the amount passed for one minute. The law requires 10 cu.m. (350 cu.ft.) of air per minute for each workman.

When tests show the presence of as much as 1 per cent. of gas in the mine atmosphere, all work is stopped and the miners are taken out. The gangways are sprayed regularly to settle the dust and the timbers are kept wet.

Wash House

On every side are evidences of the high regard which is paid to the health, safety and comfort of the miners. One of the most interesting and commendable features is the provision made for bathing and change of clothing. The wash house for the employees is one of the largest and most important buildings on the premises. It is well lighted and heated, and has cement floor, tiled walls, and is furnished with a large number of hot and cold water shower baths. Attendants keep the room scrupulously clean.

The miner coming from work goes from the shaft through a covered and heated passageway directly to the wash house. Here he divests himself of all his mine clothing and takes a complete bath, using his individual soap and towel. Then by means of a cord which passes over a small pulley suspended from the roof, he lowers to the floor a complete change of clothing. After putting on his street clothes, he attaches his working clothes to the hook on the end of the cord and hoists them nearly to the high ceiling. The working clothes are dried and disinfected by a current of hot air before he returns to work. When the miner reports for work, he goes to the wash house where he substitutes mine clothes for his street clothing, then he repairs to a near-by lamp room where he is given a certain numbered safety lamp, which has been examined, put in good condition and filled since it was last used. The mine clothes are taken away and washed semi-weekly. All the miners are required to make use of the bath rooms.

Labor, Costs, etc.

The miners work in three shifts of 8 hours each. The night shift is occupied with repair work and with timbering, walling, tracklaying, etc. The miners are paid by the car which holds about half a ton, and receive from 15 to 18c. per car according to the nature of the work. The best miners make a maximum wage that falls between $1.50 and $1.75 per day. The total number of men employed is about two thousand. The miners are given a bonus of 3c. for every prop that is recovered. The work of filling and prop placing is done by the men without extra pay.

The sanitary arrangements leave little to be desired. Closets for the men are located at convenient places underground.

The closet tanks are removed daily, emptied and disinfected before they are returned.

Equipment for Fighting Fire

A fire-engine house, well equipped with chemical engine, hose reels, hook-and-ladder truck, etc., insure protection against fire. One portion of this building contains a sufficient supply of mine rescue apparatus designed after the Draeger system. One room is used as a temporary hospital and is equipped with ambulance, stretchers and everything that is needed in first-aid to the injured. Gangs of men are regularly drilled in fire fighting and rescue work.

The excellent treatment accorded to us on the occasion of our visit to this mine is deserving of special mention. The company is unusually well prepared to take care of visitors. Before entering, we were supplied with an entire change of clothing, even including underclothes, boots and hat, and were put in charge of a competent and courteous guide. We were given every facility to inspect the plant and all information for which we inquired was freely given. After coming up the shaft, we were conducted to a room in which there were a number of bathing compartments. Each bath room had a tiled floor, porcelain tub, hot and cold water, spray baths, etc. While we were bathing, an attendant brushed our clothes and cleaned our boots.

Pricing Public Coal Lands

Special Correspondence

The United States Geological Survey is placing even greater emphasis this year upon its work of classifying and valuing the public coal lands. The national policy of promoting the most advantageous disposal of the public lands is continued under Secretary Ballinger and by his instructions the Director of the Survey is transmitting to the commissioner of the General Land Office land classifications based upon the reports of findings of the field geologists. To the fullest extent possible under the law the effort is to secure the wisest utilization of the resources of the public domain.

Recently enacted legislation gives to the agricultural entryman whose entry was made prior to the passage of the act, the privilege of electing to take the surface rights, while the coal rights are reserved for future and separate disposition. The chief of the Denver field division of the General Land Office reports that from information received in his office 90 per cent. of the Colorado entrymen in areas supposed to contain coal will elect to take title to the surface reserving to the United States the coal rights. This alone indicates the value and wisdom of this legislation which is the first important amendment of the coal land act along the lines urged by Mr. Ballinger in 1907, when commissioner of the General Land Office.

If the entryman, on the other hand, chooses to contest, then the issue becomes one of relative worth between agricultural and coal values. In a report to Secretary Ballinger, the director of the Survey stated that in the case of the North Dakota lands, to which this act was supposed to be specially applicable, while all western North Dakota, a part of which had been withdrawn as coal lands, is believed by the geologists of the Survey to be actually underlain by workable deposits of lignite, yet in all but 54 townships this area is conceded to be at present more valuable for agricultural purposes than for its deposits of low-grade coal.

The regulations for the classification and valuation of the Government coal lands as revised in April provide for a somewhat more discriminating separation of the coal and the barren lands, and for the fixing of more adequate valuations upon lands underlaid by the higher grades of coal. These changes were determined upon by the Secretary of the Interior from the consideration of present conditions in coal mining in the Western States, where thinner and deeper beds are being mined than was formerly the case, and of current practice in the matter of coal royalties collected both by the States and by private land owners. Two of the regulations indicate the spirit of these administrative measures for safeguarding the disposal of the nation's remaining coal lands. The price of coal land containing the lowest grade bituminous coal or lignites is fixed at the minimum provided by law, the intent being to thus encourage, as far as the law permits, the immediate utilization of these low-grade fuels. Another rule states that in all valuations of coal beds, any special condition enhancing the value of the land for coal-mining purposes shall be taken into consideration.

The revised scheme used in the valuation of the coal lands differs from that formerly in force in two general respects. The basis is now specifically that of coal tonnage and the land prices thus determined for the better grades of coal, anthracite and coking bituminous are somewhat higher, the maximum being raised from $100 to $300 per acre, and indeed this maximum does not hold in "districts which contain large coal mines where the character and extent of the coal deposits are well known to the purchaser."

Scheme for Valuation of Coal Lands

The plan of valuing the public coal lands by accurate determination of coal quality and tonnage is the most equitable possible, and while adequate returns are secured to the Government, the land prices thus fixed rarely amount to one-fourth of the royalties prevailing in the same districts among private interests.

The present scheme of valuation is as follows: Anthracite and coking-bituminous coals are valued at 2 to 3c. per ton. High-grade noncoking bituminous coals are valued at 1 to 2c. per ton. High-grade subbituminous and low-grade bituminous coals are valued at ½ to 1c. per ton. Low-grade subbituminous coals and lignites are valued at the minimum price fixed by law of $10 and $20 an acre. The tonnage is conservatively estimated and actual recovery ought always to exceed the tonnage upon which the valuation is based.

A few instances are cited as showing the comparative working out of valuations under the different land policies. In one township near Rock Springs, Wyoming, the valuation of which has just been completed by the Geological Survey, the coal-land values aggregate $2,800,000, on the basis of 1c. per ton. The amount for which the Government would have sold these lands on the basis of the minimum price allowed by law under the interpretation which held prior to 1906, is $460,000, while under the valuation plan of last year the amount would have been a little less than $1,000,000.

In a Montana township, near the town of Roundup, on the new line of the Milwaukee, the original amount which the Government would have received under the $20 minimum rate was $112,000; under the regulations of last year, $141,000; and under the present valuation scheme adopted April 21, by this administration, $370,000, some of the coal being now valued at $65 an acre where $20 and $25, respectively, would have been the former rates.

Near the great Castlegate coalfield in Utah the Survey is now valuing some of the Government land containing thick beds of coking coal. In this field, thousands of acres would run over the maximum of $300 an acre, as opposed to the $20 minimum price and $75 under the former valuation scheme. Dozens of other equally striking instances of comparative valuations might be cited.

Government Recovers Coal Lands

The conservatism of even the present valuation plan is clearly shown from an examination of the records in several cases where land was fraudulently entered by certain companies and in which suit for recovery of land and damages was instituted by the Government. In one instance of this kind a coal company secured a tract of land through fraudulent entries—paying $20 an acre, however—and instituted mining operations. The company has settled by paying the Government 8c. per ton royalty for all the coal mined and would have gladly accepted the privilege of being allowed to continue the mining at this rate. This, however, was not possible under the law. In this case the Government received the original $20 an acre, as well as $31,000

in royalty for the partial working of the coal on the 74 acres involved, and has also got back the land. Had the company been permitted to mine out the coal, including that left as pillars, the return to the Government would have been $1320 an acre. Under the present scheme of valuation this land would have been sold at $340 an acre.

Not only are the prices determined on the basis of the present plan believed to be not excessive, but a higher valuation would have been very properly approved by Secretary Ballinger were it not for the fact that the coal-land law limits the coal land that may be acquired to an acreage below what a mining company needs for economical operation. It is evident that a purchaser could well afford to pay a larger price per acre did the law permit the purchase of the larger tract.

It will be seen that the present coal-land policy provides for the saving to the Government and the people of enormous sums of money and prevents the monopolization by private interests of the western coalfields. The most advanced, scientific and effective methods of classifying and valuing the nation's remaining coal lands, which still constitute about 80,000,000 acres, have been adopted, and in brief the intent of the policy developed by Secretary Garfield and now further advanced by Secretary Ballinger is to promote development and economical utilization and at the same time to secure adequate returns from these valuable public lands.

Ohio and West Virginia Coal Railroads

SPECIAL CORRESPONDENCE

In a report sent to Congress May 10, the Interstate Commerce Commission has given the results of an investigation just completed with regard to certain coal roads in Ohio and West Virginia and designed to reveal their position under the "commodities clause" of the Hepburn act.

In this report the Commission presents a comprehensive history of the organization and operation of various coal companies in Ohio and West Virginia and their merging into one company which is controlled by a syndicate of railroad companies. The various coal companies considered are the Hocking Valley Railway Company, the Toledo & Ohio Central Railway Company, the Kanawha & Michigan Railway Company, the Zanesville & Western Railway Company, the Buckeye Coal and Railway Company, the Ohio Land and Railway Company, the Central States Construction Company, the Sunday Creek Coal Company, the Raybould Coal Company, the Boston Coal Dock and Wharf Company, the Kanawha & Hocking Coal and Coke Company,. the Continental Coal Company, the Sunday Creek Company, the Wheeling & Lake Erie Railroad Company, and what is known as the "Trunk Line Syndicate." This Trunk Line Syndicate consists of the Pennsylvania, the Baltimore & Ohio, and the New York Central systems, as well as the Hocking Valley, the Toledo & Ohio Central, the Zanesville & Western, the Kanawha & Michigan, the Wheeling & Lake Erie, the Chesapeake & Ohio, and the Norfolk & Western roads.

A great part of the report is taken up with a minute description of the manner in which the various coal companies and railway companies in this region were finally merged into the Sunday Creek Company, which was incorporated under the laws of New Jersey. In the history of these financial transactions the Commission goes into great detail as to the issue of stock and bonds and the giving of bonuses to various organizations accomplishing the mergers.

The report farther states that the Trunk Line Syndicate considered and passed upon track connections, operation of coal properties, reorganization of coal companies, merging of coal companies, and in general exercised supervision over such matters; also that the Trunk Line Syndicate was prominent in the policy of the roads in this district in refusing to make track connections at mines with other properties than those dominated by the syndicate.

The Commission considers that present conditions have resulted from the foregoing manipulations, and one of them seems to be the policy of the Hocking Valley and the Kanawha & Michigan railways to discourage all further development of coal mines tributary to their lines by refusal to make track connections and by imposing burdens upon the operators when the connections were conceded.

The evidence shows that in the period from 1902 to 1905 a large number of requests were made upon the Hocking Valley Railway Company by coal companies for track connections, which were not considered favorably by the railway company and in most of which the efforts of the coal companies failed.

The assistant to the president of the Hocking Valley railway could not name any other mines than the Johnson Coal Mining Company, the New York Coal Company, and the Sugar Creek mines at which connections had been made between 1900 and 1907, although it is stated that during this period there were 18 requests for connections. A similar condition of affairs appears as to the Kanawha & Michigan Railway Company in regard to refusing track connections and furnishing of cars.

It seemed to the Commission that after the organizations and mergers above described, the railway companies by various devices sought to discourage the further development of coal mines in the territory under discussion. The interest of the railroad officials in their coal companies and the guaranty by the railways of the bonds of the coal companies furnished an incentive to discourage further development of coal mines, and as far as possible to retain to these coal companies a monopoly of the coal transported by these railroads.

Coal Mining in Georgia in 1908*

The total production of coal in Georgia in 1908 was 264,822 short tons, having a spot value of $364,279.

Few States suffered more acutely from the financial depression of 1908, so far as coal production is concerned, than Georgia, the output of the State decreasing from 362,401 short tons in 1907 to 264,822 tons in 1908, a decline of 97,579 short tons, or 26.93 per cent., while the value fell off from $499,686 to $364,279, a decrease of $135,407, or 27.1 per cent. The output in 1908 was less than in any year since 1899 and can be attributed almost entirely to the depression in the iron trade, which particularly affected the production of high-grade coals and the manufacture of coke. The quantity of coal made into coke decreased from 141,031 short tons in 1907 to 71,452 tons in 1908—almost exactly 50 per cent. Of the total decrease in the State's coal production in 1908, 71 per cent. was in the quantity of coal charged into ovens for the manufacture of coke.

The number of men employed in the coal mines of Georgia in 1908 was 670, who worked an average of 261 days, compared with 808 men for an average of 262 days in 1907 and 737 men for 279 days in 1906. The efficiency record of the laborers in the coal mines of Georgia can not properly be compared with that of other States, however, as a great number—considerably more than half—are convicts leased by the State to the mining companies. Most of the men worked nine hours a day, but the statistics of production show that the average output per man each day during 1908 was only 1.51 tons, compared with 1.71 in 1907 and 1.62 in 1906. The average production per man for the year was 395 tons, compared with 449 tons in 1907 and 450.6 tons in 1906. This low efficiency is explained by the fact that the convicts employed in the mines have had no previous experience as coal miners. Where convicts are employed the operations are not subject to interference by labor troubles. There are no undercutting machines in use in the mines of Georgia. At one plant washing machinery is employed, and in 1908, 79,000 tons of coal were washed, yielding 71,452 tons of cleaned coal and 7548 tons of refuse.

*Report by United States Geological Survey.

TABLE OF WATER GAGES.

Water Gauge.	Ventilating Pressure Pounds per Sq. Ft.	Pressure Ounces per Sq. Ft.	Pressure Ounces per. Sq. In.	Velocity of Air Feet per Min. 481.2 $\sqrt{h}$	Hight of Air Column. One Cu. Ft. Weighs .0763 Lb.	Foot pounds in 1000 Cu. Ft. of Air.	Horse Power In 1000 Cu. Ft. of Air.
0.1	0.52	8.32	0.05	1,251	6.8	520	0.016
0.2	1.04	16.64	0.12	1,780	14.0	1,040	0.031
0.3	1.56	24.96	0.17	2,465	20.4	1,560	0.048
0.4	2.08	33.28	0.23	2,502	27.2	2,080	0.063
0.5	2.60	41.60	0.28	2,839	34.1	2,600	0.079
0.6	3.12	49.92	0.34	3,079	40.9	3,120	0.081
0.7	3.64	58.24	0.40	3,272	47.7	3,640	0.110
0.8	4.16	66.56	0.46	3,560	54.6	4,160	0.128
0.9	4.68	74.88	0.51	3,777	61.4	4,680	0.141
1.	5.20	83.20	0.58	3,945	68.2	5,200	0.159
1.1	5.72	91.52	0.63	4,138	75.0	5,720	0.173
1.2	6.24	99.84	0.70	4,330	82.0	6,240	0.188
1.3	6.76	108.16	0.75	4,523	88.7	6,760	0.205
1.4	7.28	116.48	0.80	4,715	95.5	7,280	0.225
1.5	7.80	124.80	0.86	4,860	102.3	7,800	0.236
1.6	8.32	133.12	0.92	5,052	109.2	8,320	0.252
1.7	8.84	141.44	.96	5,148	116.0	8,840	0.268
1.8	9.36	149.76	1.03	5,293	122.8	9,360	0.283
1.9	9.88	158.08	1.10	5,485	130.0	9,880	0.299
2.	10.40	166.40	1.15	5,630	136.4	10,400	0.315
2.1	10.92	174.72	1.21	5,726	143.3	10,920	0.331
2.2	11.44	183.04	1.27	5,870	150.0	11,440	0.348
2.3	11.96	191.36	1.32	6,015	157.0	11,960	0.362
2.4	12.48	199.68	1.38	6,111	163.7	12,480	0.378
2.5	13.	208.	1.44	6,255	170.0	13,000	0.390
2.6	13.52	216.32	1.50	6,399	177.4	13,320	0.409
2.7	14.04	224.64	1.56	6,592	189.0	14,040	0.425
2.8	14.56	232.96	1.61	6,640	191.0	14,560	0.441
2.9	15.08	241.28	1.68	6,784	200.0	15,080	0.456
3.	15.60	250.6	1.72	6,833	204.0	15,600	0.471
3.1	16.12	257.92	1.80	6,977	211.5	16,120	0.490
3.2	16.64	266.24	1.84	7,073	219.0	16,640	0.504
3.3	17.16	274.56	1.89	7,200	225.1	17,160	0.520
3.4	17.68	282.88	1.96	7,266	230.7	17,680	0.536
3.5	18.20	291.20	2.01	7,410	238.8	18,200	0.551
3.6	18.72	299.52	2.08	7,554	245.6	18,720	0.567
3.7	19.24	307.84	2.13	7,602	252.4	19,240	0.583
3.8	19.76	316.16	2.20	7,747	260.0	19,760	0.600
3.9	20.28	324.48	2.25	7,843	266.1	20,280	0.614
4.	20.80	332.80	2.30	7,939	272.9	20,800	0.631
4.1	21.32	341.12	2.36	8,036	280.0	21,320	0.646
4.2	21.84	349.44	2.42	8,180	286.6	21,840	0.661
4.3	22.36	357.76	2.46	8,276	297.0	22,360	0.677
4.4	22.88	366.08	2.54	8,324	300.3	22,880	0.693
4.5	23.40	374.4	2.58	8,421	307.0	23,400	0.709
4.6	23.92	382.72	2.65	8,517	313.9	23,920	0.724
4.7	24.44	391.04	2.71	8,613	320.7	24,440	0.740
4.8	24.96	399.36	2.80	8,709	327.5	24,960	0.753
4.9	25.48	407.68	2.83	8,757	334.2	25,480	0.773
5.	26.00	416.00	2.87	8,854	341.2	26,000	0.789
5.1	26.52	424.32	2.94	8,950	348.0	26,520	0.800
5.2	27.24	435.84	3.02	9,046	357.4	27,240	0.825
5.3	27.56	440.96	3.04	9,142	362.0	27,560	0.835
5.4	28.08	449.28	3.10	9,239	370.0	28,080	0.850
5.5	28.60	457.6	3.17	9,287	375.0	28,600	0.866
5.6	29.12	465.92	3.23	9,383	382.1	29,120	0.884
5.7	29.64	474.24	3.30	9,479	389.	29,640	0.900
5.8	30.16	482.56	3.38	9,624	400.	30,160	0.193
5.9	30.68	490.88	3.40	9,667	402.5	30,680	0.930
6.	31.20	499.20	3.44	9,768	409.4	31,200	0.940
6.1	31.72	507.52	3.50	9,816	416.2	31,720	0.962
6.2	32.44	519.04	3.55	9,912	425.3	32,440	0.983
6.3	32.76	524.16	3.61	9,96[illegible]	431.3	32,760	0.993
6.4	33.28	532.48	3.67	10,057	436.7	33,288	1.000
6.5	33.80	540.8	3.73	10,105	443.4	33,800	1.024
6.6	34.32	549.12	3.81	10,201	450.0	34,320	1.042
6.7	34.84	557.44	3.87	10,297	457.6	34,840	1.056
6.8	35.36	565.76	3.92	10,345	464.0	35,360	1.071
6.9	35.88	574.08	3.98	10,442	470.8	35,880	1.083
7.	36.4	582.40	4.01	10,490	479.0	36,400	1.103
7.1	36.92	590.72	4.10	10,583	484.5	36,920	1.120
7.2	37.64	602.24	4.17	10,682	494.0	37,640	1.140
7.3	37.96	607.36	4.19	10,730	498.4	37,960	1.150
7.4	38.48	615.68	4.24	10,778	505.0	38,480	1.166
7.5	39.00	624.	4.30	10,875	511.8	39,000	1.181
7.6	39.52	632.32	4.40	10,923	518.6	39,520	1.193
7.7	40.04	641.12	4.45	11,019	525.5	40,040	1.213
7.8	40.56	648.96	4.50	11,067	532.6	40,560	1.230
.9	41.08	657.28	4.56	11,163	539.2	41,880	1.242
8.	41.6	665.60	4.52	11,211	546.0	41,600	1.262
8.1	42.12	673.92	4.68	11,260	552.5	42,120	1.274
8.2	42.84	685.44	4.70	11,404	562.3	42,840	1.300
8.3	43.16	690.56	4.76	11,452	566.3	43,160	1.308
8.4	43.68	698.88	4.82	11,500	573.7	43,680	1.320
8.5	44.20	707.2	4.87	11,548	580.0	44,200	1.340
8.6	44.72	715.52	4.96	11,645	586.7	44,720	1.360
8.7	45.24	723.84	5.02	11,693	593.3	45,240	1.370
8.8	45.76	732.16	5.08	11,741	600.0	45,760	1.386
8.9	46.28	740.48	4.16	11,836	607.4	46,280	1.400
9.	46.80	747.80	5.20	11,885	614.6	46,800	1.415
9.1	47.32	758.12	5.25	11,981	621.0	47,300	1.432
9.2	48.04	768.64	5.28	12,030	630.4	48,040	1.452
9.3	48.36	773.76	5.33	12,078	634.6	48,360	1.465
6.4	48.88	782.08	5.43	12,174	641.7	48,880	1.481
9.5	49.40	790.40	5.45	12,220	648.3	49,400	1.500
9.6	49.92	798.72	5.50	12,270	655.3	49,920	1.513
9.7	50.44	807.04	5.60	12,366	662.0	50,440	1.525
9.8	50.96	815.36	5.66	12,414	668.3	50,960	1.542
9.9	51.48	823.68	5.72	12,463	675.5	51,480	1.560
10.	52.	832.00	5.74	12,511	681.2	52,000	1.600

NOTE.—Table is based on one cubic foot of water, weighing 62.4 pounds. A column of water 1 inch in depth and 1 square foot in area equals 5.2 pounds.

Table of Water Gages

The accompanying table of water gages was compiled and copyrighted by Charles Kuderer, of Woodlawn, Penn. It is based on actual tests made on a centrifugal mine-fan wheel, 3 ft. wide, 6 ft. in diameter, and with 2 inlets of 3 ft. diameter. The fan wheel was inclosed in a casing, the air flowing from this casing into the atmosphere; the pressure in the fan casing and the corresponding air velocity were taken.

Tin Deposits of the Carolinas

By S. Mays Ball*

Tin is reported as having been discovered in North Carolina near Kings Mountain in 1883. It was not until 1886, however, that systematic prospecting was carried on in this vicinity. In 1888 a 10-stamp mill was erected by Mr. Ledoux and associates for test purposes, but owing to litigation, work on the property ceased in the latter part of 1899. A little work was done on the Chestnut Hill property about 1892. Since that time, little or no work was done on the tin belt until 1903, when the Ross mine, at Gaffney, S. C., was discovered. The principal developments to date are the Ross mine, at Gaffney, S. C.; the deposits in the vicinity of the town of Kings Mountain, N. C.; on the southern end of Chestnut Ridge, about 2½ miles northeast of Kings Mountain; and on the plantation of John E. Jones, 7 miles northeast of Kings Mountain.

The Ross Mine

The principal development of the tin belt has been done at the Ross mine, situated about one mile easterly from Gaffney, S. C. Near the top of a low hill, beside which flows a small stream, a shaft was sunk and an open cut made; in these were found saprolitic-pegmatitic dikes, carrying varying amounts of tin ore. Just above this shaft and pit another shaft 40 ft. deep was sunk. Trenches were cut across the supposed strike of the veins, but only a small amount of tin was obtained. Numerous pits and trenches in the vicinity showed from 12 to as high as 75 lb. of tin ore to the cubic yard. The average for the soil and gravel is about 25 lb. per cubic yard.

A 40-ft. trench run back from the stream showed some good ore in the sand and gravel overlying bed rock. The area over which cassiterite has been found in the soil and gravel is about 1000x600 ft.; all of this material will undoubtedly pay to wash.

Other Tin Deposits

Tin ore is found at a point about three miles above Grover, N. C.; a distance of about 13 miles from the Ross mine. From this point it has been found almost continuously to points a mile or two above Lincolnton, N. C.; a total distance of about 28 miles. However, the principal deposits are at a distance of 7 miles northeast and southwest of Kings Mountain.

The Ledoux property is situated about 4½ miles southeasterly from Kings Mountain. This was worked extensively some years ago by trenches and a shaft, but is now idle. Tin ore has been found at various points on the plantation of E. C. Faires, and also on the Weir plantation, just southwest of Kings Mountain. Northeast of the Faires plantation some work has been done on the Falls property. A number of shafts were sunk and trenches cut and some rich ore encountered, but it was found to be pockety. Cassiterite, in the form of small pieces from the size of a grain of sand to that of a pea, has been found in small quantities at various other points in this vicinity.

About two miles northeast of Kings Mountain, toward the southern end of Chestnut Ridge, on the property of M. M. Carpenter, tin-bearing boulders weighing from 50 to 100 lb. each have been found. A little to the east of the summit of Chestnut Ridge, about ½ mile from the Carpenter property, a shaft was sunk 122 ft. on a tin-bearing vein. This is reported to be 7 ft. wide at 100 ft. depth, and is said to carry 3 per cent. tin oxide. Judging from the dump, there was not a great deal of tin ore removed from the shaft. It is reported that ore was encountered in a trench on the Ormond property, on the north end of Chestnut Ridge. On the Hovis property, about 2 miles from the Ormond property, little tin has been encountered, but the ground adjoining it on the north again shows prominent tin-bearing boulders.

The Ramseur Mill property lies about 1/3 mile northeast of the Ormond; here a large pegmatitic dike outcrops, and a great deal of cassiterite has been found as float. A trench on this ground also exposed rock carrying cassiterite. One of the most promising deposits is found at the Jones mine, about 7 miles northeast of Kings Mountain and 3½ miles northeast of Bessemer. A number of shafts were sunk here, but they have since partly filled with waste, etc.

Production of Tin from the Carolinas

The first production of tin from the Carolinas was made in 1903, when the Ross mine shipped 38,471 lb. of tin concentrate to England for treatment. The Jones mine also produced some ore during development work, but none was shipped. No shipments were made during 1904, but development work was actively carried on by the Carolina Tin Company at the Jones mine. The Beaver Dam property, 11

*Atlanta, Ga.

miles northeast of Kings Mountain, was also worked in 1904. There was no production in 1905, although prospecting and development were actively carried on in the Kings Mountain district. At the old Ledoux mine, a mill was erected to handle, not only the Ledoux ores, but those from other neighboring properties. During 1905, a small mill was erected at the Jones mine; a small amount of ore was treated, but none was shipped. The property was worked to a depth of 100 ft. and some very good ore was exposed. Perhaps the most extensive development in 1905 was on the property of the Piedmont Tin Mining Company, beginning 2 miles southwest of Lincolnton. The property is about 2 miles long and 1 mile wide and has been prospected almost over its entire area. The greatest amount of underground work was done at the Main and Henry shafts.

In discussing the work in the Carolina tin belt for 1905, Dr. Joseph Hyde Pratt, geologist of North Carolina, states that although a comparatively large amount of work had been done, it had not yet proved conclusively the real value of the tin belt. The work demonstrated, however, that economical and careful management will be necessary to make the deposits profitable.

Much development work was done in North Carolina during 1906 and 1907, but no ore was shipped or sold. The Piedmont Tin Mining Company began the erection of a mill to treat its own ore. Present conditions are about the same as those of 1906 and 1907.

Cadmium in Soft Solders

While ordinary solder answers well for many kinds of work, in others its melting point is not sufficiently low. Erwin S. Sperry (*Brass World*, May, 1909) states that the mixture of about two parts of tin and one part of lead has the lowest melting point of any of the tin and lead mixtures, so that it is impossible with tin and lead alone to obtain a more fusible solder than this one. It is not generally known that the addition of cadmium to soft solder containing tin and lead greatly improves it by lowering its melting point and increasing its strength. Now that cadmium can be obtained at a reasonable price, its use in making a soft solder with a low melting point should become extensive.

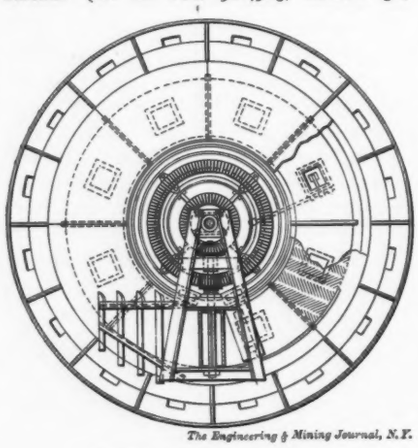
The best mixture for the soft solder containing cadmium has been found to be the following: tin, 50 per cent. (2 parts); lead, 25 per cent. (1 part); cadmium, 25 per cent. (1 part). The metals are melted together and a small quantity of sal-ammoniac is used on the surface as a flux. This cleans it well. Before pouring into bars, the solder should be well stirred in order to thoroughly mix the metals. When cast, the bars of this solder have a slight roughness on the surface caused by crystallization, but this does not detract from their value. The cadmium increases the strength of the solder as can be easily ascertained by bending the bar. The stiffness will usually surprise those who are accustomed to use ordinary soft solder.

The melting point of this cadmium solder was carefully tested by means of an accurate thermometer and found to be 292.1 deg. F. (144.5 deg. C.). This is about 30 deg. lower than the best solder composed of two parts of tin and one part of lead.

As cadmium is now not very expensive, the cost of the solder is not increased very much. It will be found useful for soldering soft metals such as brittania, pewter, antimonial lead and similar metals of a low melting point, and will tend to render the soldering operation much safer, as there is less danger of melting the metal to be soldered.

Roasting Furnace

Francis D. Weeks, of Salida, Colo., describes (U. S. Pat. 916,903, March 30, 1909) an apparatus for calcining, agglomerating and sintering ores. As applied to a circular furnace, the apparatus is illustrated in the accompanying engraving showing a top plan view, partly sectional. The ore is put into a hopper mounted on the revolving frame and fed automatically to a stationary perforated grate below. The frame revolves slowly enough to permit an oil or gas burner at one side of the hopper opening to ignite the ore as it is discharged and air drawn or forced through the ore completes the combustion. When the frame has completed a revolution, that portion of the ore first ignited has become sufficiently calcined or sintered and is ready to be discharged from the grate surface by the scrapers attached to the revolving frame. The ore to be treated is not moved from the time it is deposited on the grate until discharged into the bins around the periphery of the furnace. While a circular furnace is shown in the accompanying engraving, the apparatus may be applied to a straight-line furnace.



WEEKS ROASTING FURNACE

Conditions in Nicaragua

Judging from the reports of miners and others returning from Nicaragua, that country offers little or no inducement to the miner seeking employment. The majority of the mines employ negroes and natives almost exclusively, even on their staffs, because of the low cost for this class of labor. The few mines that prefer white men are overrun with applicants for work. It is reported that many efficient miners, unable to secure employment, have found it necessary to apply to charity for funds with which to leave the country. Prospectors, unless plentifully supplied with money, fare even worse than the miners. Local assistance is practically impossible to secure, and as living expenses are very high, the prospector out of funds faces a serious problem. Some of the more unfortunate have found it necessary to walk out of the country on the beach over to Costa Rica or Honduras, feeding on cocoanuts and crabs during their tiresome journey.

It seems that there are on the Atlantic coast of Nicaragua promising deposits of various minerals, but without the aid of foreign capital, there is little hope for their development. The excessive import duties on provisions and export duties on gold have in a large measure retarded the investment of foreign capital. Mining concessions, moreover, are very questionable under all circumstances. Not only are mineral concessions contrary to the constitution, but all of them contain loopholes so that they can be annulled under some pretext or other. Mineral concessions are often obtained by parties who have not the slightest intention of working the properties, but who plan to pass them off on the uninformed foreigner for whatever they can get.

Mines which have been acquired under the mining code are, of course, fully protected, and such mines may be made to yield a fair profit by judicious management. Good prospects are numerous, but the money to work them must come from the outside.

In Russia there are several salt lakes and rock-salt deposits in the Caucasus. According to consular reports, the more important ones belong to the state and are situated principally in the governments of Erivan, Baku and Stavropol, and in the provinces of Kars, Daghestan and Ter. Their annual output is estimated at about 1,500,000 poods (24,190 tons). All salt produced in the Caucasus is either locally consumed or sent to Central Asia markets; none of it is exported.

The Determination of Tungstic Acid in Low-grade Ores

The determination of small quantities of tungstic acid by known methods is difficult, and involves much time and labor. In a paper by H. W. Hutchin and F. J. Tonks (*Inst. Min. and Met.*, Bull. No. 56, May 13, 1909), the three methods of analysis in common use are described; in addition, a new scheme, more speedy and accurate, is investigated. Following are the methods of analysis in common use: (1) The aqua regia method; (2) aqua regia method with previous treatment with hydrofluoric acid; (3) fusion with alkalis and subsequent determination with mercurous nitrate.

Aqua Regia Method

Five grams of the finely powdered sample are digested at the boiling point with 50 c.c. of hydrochloric acid for several hours; 10 cc. nitric acid are then added and the digestion continued for one or two hours. The assay is well diluted with water and allowed to stand over night. After filtering and washing, the tungstic acid in the residue is dissolved in dilute ammonia, filtered and the ammonium-tungstate solution evaporated in a platinum dish. The tungstic acid obtained from ignition of the ammonium tungstate is evaporated with hydrofluoric acid to remove silica, and again ignited.

Aqua Regia Method with Previous Treatment with Hydrofluoric Acid

Five-gram charges are evaporated with hydrofluoric acid in a platinum dish to dryness. The dried residue is subsequently transferred to a beaker with water, giving a volume of about 40 c.c.; 5 c.c. nitric acid are added and the assay gently warmed to remove the bulk of the mispickel. After diluting well and allowing to stand over night, it is filtered and the residue washed on to the paper, dried and burned. The residue, after powdering again in an agate mortar, is decomposed by aqua regia, etc., as previously described.

Determination by Fusion with Alkalis and Subsequent Determination with Mecurous Nitrate

The silica and mispickel are removed from a 5-gram charge as described in the previous method. The residue is again powdered and fused in a nickel dish with caustic soda and sodium peroxide. The melt, when cold, is extracted with water and diluted to 250 c.c., of which 200 c.c. of a filtered proportion is used for the actual assay. The alkaline liquor is acidulated with nitric acid, followed by ammonia, till fairly alkaline, boiled, filtered and washed. The filtrate containing the tungsten is made neutral or faintly acid with nitric acid; mercurous nitrate solution is then added, followed by a little freshly precipitated HgO or a few drops of diluted ammonia. After warming and stirring, the precipitate settles well. It is determined as WO_3 by ignition in a platinum crucible, followed by treatment with hydrofluoric acid.

New Method

That wolfram is decomposed by boiling or by digestion on a water bath with caustic soda solution, was noted in the course of laboratory experiments on wolfram products. Investigations followed to see if the reaction could be adapted to replace the fusion with soda. With a view to its use as a solvent for wolfram in low-grade ores it was desirable first to test it on wolfram concentrate. A sample of wolfram concentrate was selected which had been agreed upon by buyer and seller; it contained 63.2 WO_3.

The finely powdered sample (0.4146 gram, was digested on a water bath with about 1½-inch stick soda and 15 c.c. of water in a porcelain dish for 45 min. The assay was diluted with water, a little sodium peroxide added, filtered and washed. The tunstic acid was determined in the filtrate by mercurous nitrate after removal of silica, etc., as in previous methods. The weight of WO_3 obtained was 0.2610 gram = 62.97 per cent. WO_3. The decomposition of wolfram under such conditions was sufficiently complete to make possible the assay of low percentages.

Details of New Method as Used for Low-grade Ores, Tailings, etc.

The charge taken may be 5 grams or more; it is better, however, to use 5.6, 11.2, 16.8, or any convenient multiple of 2.8, so that the milligrams of tungstic acid obtained represent simple ratios of pounds of WO_3 per long ton of ore. The reason for taking 2.8 grams (or multiple) is because only four-fifths of the solution is used for the actual assay, i.e., it is a convenient sort of assay ton for pounds per ton of 2240 lb. under the special conditions of the assay. The charge is digested in a 4-in. porcelain dish with 20 c.c. of a 25-per cent. solution of caustic soda (free from chloride) on a water bath for 30 to 45 min. The assay is next diluted, a little sodium peroxide added to oxidize any decomposition products of sulphides, then transferred to a ¼-liter flask and diluted to 250 c.c.; 200 c.c. of a filtered portion are first acidified with nitric acid, then made alkaline with ammonia. The assay is brought to the boiling point, filtered and washed. The filtrate is made slightly acid with dilute nitric acid, and mercurous nitrate solution added in excess, followed by a few drops of dilute ammonia. On warming and stirring, the precipitate settles readily. After filtering and washing the precipitate with weak mercurous nitrate solution, the paper and precipitate are ignited together in a porcelain crucible; or, if the ore is free from arsenic, in a platinum crucible. Weigh as tungstic acid; with a charge of 5.6 grams, the milligrams obtained, divided by 2, give pounds of WO_3 per ton.

For assays of ores and tailings, the sample may be reduced to a sufficient degree of fineness in a wedgwood mortar, but for concentrates an agate mortar is necessary; fine powdering is essential. For decomposing charges containing not more than 0.4 gram of tungstic acid, 20 c.c. of a 25-per cent. solution of caustic soda is sufficient. The attack with soda is rapid under these conditions, 0.4 gram of wolfram concentrates being decomposed in 15 min. to the extent of 98 per cent. of its tungsten content. As a rule, however, from 30 to 45 min. is given.

Strength of Mercurous Nitrate Solution

The solution may be conveniently prepared from mercury. From 2 to 3 oz. of mercury is digested on a hot plate for 1½ hours in a large beaker or flask (the hot plate being near the boiling point) with 25 c.c. of nitric acid (specific gravity 1.4) and 75 c.c. of water, and left on the hot plate over night. The extract, diluted to about 400 c.c., will give a saturated solution with the minimum of free acid; 20 c.c. is sufficient for most assays.

Where a porcelain crucible has (from the presence of arsenic in the ore) necessarily to be used, it is advisable to burn a batch of precipitates one after the other, and at the end transfer the accumulated tungstic acid to a platinum crucible for treatment with hydrofluoric acid. The loss of hydrofluoric acid is usually very small, e.g., on three assays of mineral from the battery, working with a charge of 5.6 grams, the total loss was 0.5 mg., equivalent to 0.08 lb. per ton on each assay. In the presence of scheelite, the method is not applicable, since the mineral is only partly attacked under the conditions of the assay.

According to the *Aust. Min. Stand.*, April 7, 1909, several discoveries of diamonds in Australia have been recorded Some of them, notably those in the neighborhood of Bingera, Cope's creek and Inverell, have demonstrated the existence of the gems in fair number, but mostly of small size.

Statistics collected for The Mineral Industry show that the production of cadmium in the United States in 1908 was 10,000 lb., valued at $9300. This was the second year that cadmium was produced in the country, 15,000 lb., valued at $18,750, being produced in 1907.

Rules for Smokeless Consumption of Fuel

By Robert Grimshaw*

That the smokeless consumption of fuel by others than ourselves is a desirable end to attain, we are all ready to admit; but as a rule, we consider it to be an altruistic ideal which we cannot afford to entertain. There are times, however, when the law steps in and calls for it; and then we suddenly find that it is attended with fuel economy. The trouble is, how to attain it. The *"Magdeburger Verein für Dampfkesselbetrieb"* or "Association for Boiler Running," has laid down several rules by which the result may be attained; and the first four conditions are as follows:

1. During combustion there must be sufficient air supply.

2. The air and the combustion gases require constant intimate mixture.

3. In the fire-chamber it is necessary that all shall be red-hot, in order to ignite the incompletely consumed combustion gases.

4. Very solid fuel requires time for its complete combustion.

The permanent fulfilling of these conditions is certainly attended with a series of difficulties. The main trouble lies with the constant change of all the conditions and processes connected with combustion. For instance, the varying call for heat, caused by the fluctuating demand for steam, the varying size of the mass of coal on the grate, the intermittent addition of new coal thereon, the coking of the coal layer, the gradual collection of cinders and slack on the grate—all aid in effecting a constant change in the conditions of combustion, and increase the difficulty of maintaining the conditions constant. Farther, every kind of coal has different qualities from all the others. It is then not sufficient that the stoker shall know the proper conditions for perfect combustion; he must be careful and have practice, in order to combat the difficulties which confront him.

The Layer of Coal Must Not Be too Thick

In order that the proper amount of air shall always be present, the layer of coal on the grate must be kept loose and penetrable; that is, it must not be too thick. The proper thickness has to be learned by experience; so that with the greatest amount of draft, all the air that passes through shall be consumed. Naturally, coal which lies loosely on the grate may be carried thicker than that which by reason of its size and shape packs closely. The smaller the coal, the thinner the layer may be. The pieces should not be larger than one's fist; larger ones must be broken up; those the size of a potato being the best. With medium draft, the layer can be about 4 in. high. Pea and buckwheat coal should be fired only about 2 in. high or even less.

Whatever is the best thickness of layer on the grate, the stoker should keep it regular. He should not let the fuel burn too long without adding fresh coal. "Little and often" should be the rule. In firing, the layer should be kept as level as possible, that is, the thin places should receive special attention, so as to keep the layer level. I also believe that the fire should always be a trifle higher along the edges of the fire-chamber than in the center; there are apt to be leaks, and any draft in this circumferential line tends to cool down the walls, which should be kept glowing. Every locomotive fireman sees this without being told. The glow under the freshly laid coal should not be smothered; it must radiate through the new material into the combustion chamber; the flames should at once, on the fire-door being closed, break out anew and light the gases evolved from the latter. The fresh coal is to be strewed over the entire surface; not shoveled in, as into a wheelbarrow. Fresh coal is to be added as soon as the flame on the grate is thin and short, and before the glow is checked.

If enough air cannot be got through the grate to burn the gases evolved from the new coal, sufficient must be admitted through the partly open fire door to effect this; but only as long as these gases are evolved. The proper time can be determined by experiment.

Coking coal must be sliced before firing anew; otherwise it will not allow sufficient air to pass through it. This slicing often causes a greater development of gas than fresh firing; so that after slicing, air should generally be let in above the grate.

In order to mix the air as thoroughly as possible with the combustion gases, it is well to have a contracted space back of the fire-chamber. The size and shape of this space are best determined by experience, each case for itself.

The strength of the draft is not to be judged by the smoke, but measured by a manometer. If considerable air over the grate is desirable, and only a small amount of draft is necessary for the steam demand, it may be best to blow in the air above the fire; but for simplicity's sake this is, as far as possible, to be avoided.

Control of the Fire

Control of the condition of the fire is afforded by the flame. When seen from behind, it should not be short and broken, nor should it wave like a flag in the wind. This latter would be the sign of too thin a layer of coal on the grate. Under such conditions the flame is perfectly white, and the chimney does not smoke; but outside of the case of very "thin" coal, that is, that which is not "fat," the proper flame should be long, say 2 to 4 in.; must fill the entire flue passages, and roll and wave like a fiery sea. Such a flame is not perfectly white, but red or yellow. In any case it is bright, and the chimney will smoke but little, with a very gray smoke.

If the flame is dark, black and long, the stack will smoke plentifully; this is caused by lack of air or heat or both together in the fire-chamber.

The layer of coal should be disturbed as little as possible; it should be lessened only if it cokes or cakes. In such cases, one should be careful to let the ashes and cinder lie as far as possible untouched on the grate, and not let them get mixed with the coal; otherwise they will melt, cover the coal with a coating, and prevent its combustion. It is best that the cinder should not melt on the grate, but lie thereon as a dry, loose, porous mass. As soon as the ashes restrict the room in the fire-chamber, or the supply of air through the grate, they must be drawn off. It is advisable to have the upper edges of the grate bars slightly grooved, so that there will always be on each one a slight protecting layer of ash which will prevent them burning.

If the damper is always open, and after the admission of air above the grate there is not enough steam, that is a sign that the plant is overworked, and that smokeless combustion is impossible.

The above rules are especially adapted for stepped grates, and "half anthracite" coal.

*Engineer, Dresden-A, Germany.

An interesting experiment was made recently at the Garswood Hall colliery in Scotland. The screens at this colliery are near the downcast shaft, and a considerable quantity of dust is made in the process of screening, some of which finds it way back into the mine along with the ventilation. To obviate this, water-sprays have been fitted up at the bottom of the shaft, and also a frame has been put in the main airway a little distance from the shaft. Arranged around this frame are several sprays, the object of which is to wash the dust from the air as it passes through the frame. Quite a considerable amount of dust is thus washed out. With 40,000 cu.ft.of air passing through, 7½ lb. (weight after drying) of dried dust were recovered by means of a settling-tank in 14 hours, and probably as much more escaped collection, which means that the sprays washed down 14 or 15 lb. in the 14 hours. This dust originated partly at the screens and partly from the trams in the pit-shaft.

In the Usher sand process the pulp is run directly from the mill into the treatment tank where, as the tank fills, it is claimed that the slimes are completely separated and run to the slimes plant, leaving only clean sands in the vat, and after a short time only for draining, the treatment is started without the delay and cost of transfer.

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The Economics of Natural Gas Supply

Even at the present time there is a great deal of misapprehension respecting the value of a supply of natural gas. It is now well recognized that in no case is the supply inexhaustible, but on the contrary, with respect to any particular reservoir it is likely to be of short duration. Also it is now recognized that natural gas is not a costless fuel, although those who in the early days of some fields were able to obtain four or five million cubic feet per day from a single well (costing about $1500), connected with the factory by perhaps 2000 ft. of 4-in. pipe line, obtained a supply of fuel at very low cost indeed. In some cases, it was possible to obtain a gas well within the yard of the works. Such favorable conditions, however, no longer exist; or if they do, the instances are extremely rare.

A supply of natural gas involves expense under the following heads: (1) Acquisition of property and the right to drill for gas, either by purchase of the fee or by lease. (2) Drilling and equipping the wells, cost of which varies with the depth to which drilling must extend, and also with the percentage of dry holes. (3) Connection of the wells by pipe lines to the place where the gas is to be used, ordinary industrial piping being frequently from five to eight miles in length, the size of the pipe being commonly 4, 6 or 8 in. (seldom as small as 4 in. for a line of such lengths). (4) Care of wells, pipe lines and other equipment, an ordinary industrial supply usually requiring the continuous attention of a fieldman. (5) Prospecting and development, in order to extend the supply to take the place of that which is exhausted.

The gas lands of an industrial company, which furnish its fuel supply, are analogous to coal mines, and they should be considered as an independent mining department. Otherwise, the real cost of the fuel is likely to be overlooked. Gas mines differ from coal mines in that their product is not confined, and that other persons may secure it, unless the territory controls the entire area of a pool, which it is rarely possible to accomplish. In brief, gas lands merely confer the right to take gas from a common reservoir.

Natural gas occurs in nature in strata of sandstone lying at various depths below the surface. The original rock pressure appears to be more or less in proportion to the depth below the surface, being the higher the greater the depth. In order to retain an accumulation of gas, the sandstone must be covered by a stratum of some impermeable rock. The precise manner in which the natural gas occurs in the sandstone is unknown; but whether the original occurrence be as a gas or as a liquid saturating the porous sandstone, it is found that the existence of the gas is confined to certain circumscribed areas, which may be pictured as subterranean lakes, or pools, as they are commonly called. The existence of a pool having been determined, a well drilled anywhere within its boundary is likely to find gas; but not necessarily, inasmuch as it may go down in a barren spot, which may be conceived to be an island in the pool. As illustrative of the dimensions of a gas pool, the well-known Iola pool in Kansas may be cited. This was about 10 miles long and about three miles wide, and is perhaps the largest single pool yet found in Kansas. We have had occasion to study other pools, but none of which the dimensions were so great or the uniformity of the gas occurrence so striking as at Iola.

A gas pool is a reservoir of a more or less quantity of gas. When the gas has been drawn off, the life of the pool is ended. As the gas is drawn off, the pressure goes down. The condition is precisely analogous to that of a reservoir containing a quantity of compressed air. As the air is drawn off through a single outlet, the pressure decreases; and if it be necessary to obtain the same quantity of air, another outlet must be opened to secure it at the diminished pressure. So it is with a natural-gas pool. A few wells may for a time deliver a certain quantity of gas; but as the pressure goes down, the volume of gas delivered decreases also; and to maintain the supply, more wells must be sunk into the gas stratum.

In close connection with the gas, but in a way that is not clearly understood, is water. At the end of the life of a gas pool, water comes into the sand where the gas was originally. Sometimes the water does not come in until the gas pressure has fallen nearly to zero. In

other cases, water is a source of trouble and frequently cuts out a well when the gas pressure is still high. Why this should happen, we cannot say, but it is a fact that experience has shown. In this respect there is a considerable difference among gas pools. Some may continue to yield gas down to atmospheric pressure, or even less, in the latter event the gas being sucked out mechanically. In other pools, the gas supply of a well may be cut off by the influx of water when the gas pressure is still high, even as high as 300 or 400 pounds.

The measured volume of a gas well, or gas pool, is no criterion of its value. Measurements of volume are frequently of doubtful accuracy, and the occurrence of wells of large volume indicates merely that the sand is able to deliver its gas quickly without affording any idea of the quantity of gas existing in the subterranean reservoir. It has been the experience in Kansas that the wells of most endurance have been those of comparatively small flow that have been found in a dense sand which was the case of Iola. We have known a single well, or a pair of wells at that place, to supply large zinc smelters for three or four years. On the other hand, wells of immense volume, tapping a loose, open sand, have died out in a comparatively short time under a moderate draft.

An industrial company that is supplying itself with natural gas must, consequently, be careful and conservative in its figuring in order to be sure that what is apparently very cheap fuel is in reality cheap only at the expense of capital account. The actual cost is sure to develop in the final summing up, but inasmuch as that may be postponed indefinitely the opportunity for self-deception is expansive. The only safe course is to charge fully the gas supply with the current expenses of maintenance, and in addition make a liberal allowance for amortization to reimburse the principal invested. This allowance will be governed by the estimate of probable life of the pool, which is highly uncertain. An approximate idea may be obtained by periodical gaging of the wells tapping the pool and determining the rate of diminution of pressure. For this purpose, field observations should be made frequently and should be carefully recorded. In forecasting the probable life of a pool, however, the investor should be given the benefit of every doubt, in this more so than with respect to any other kind of venture.

The Price of Lake Ores

With very little preliminary discussion, the prices of Lake Superior iron ore for the present season have been fixed at last year's standard. These prices, on dock at a Lake Erie port, where most of the sales are made, are $4.50 per ton for Old Range bessemer; $4.25 for Mesabi bessemer; $3.70 for Old Range and $3.50 for Mesabi nonbessemer. The base guarantees are unchanged also, being 55 per cent. iron and under 0.45 phosphorus for bessemer ores; 51.5 per cent. iron for nonbessemer ores.

The adjustment of these prices no longer possesses the importance which it once had, since they apply only to the class of merchant furnaces which do not own their ore supply; or which use local ores to some extent and buy Lake ores to mix with them. The Steel Corporation and all the larger independent companies own their mines, and the price of ore to them is the cost of mining and delivering it. The mining may be conducted by a nominally separate corporation—in fact, it usually is—but any profit or loss shown by such a subsidiary is only a matter of bookkeeping, and it is the actual cost which enters into the calculation of the value of the final product.

There are, of course, wide variations in the cost of mining in the Lake Superior region. The ton of ore can be put on the cars for a much lower immediate price at one of the large steam-shovel mines on the Mesabi range than at a Menominee or Gogebic mine where hoisting is required and where it may be necessary to handle large quantities of water. The variations are not so great, however, when the heavy preliminary expenses of stripping and preparation for open-pit mining, under the present system, are taken into account. The cost of handling and carrying the ore to a Lake Erie port are nearly uniform and are well known; they will average about $1.60 per ton. If we take this average and add the cost of mining, there is probably, at this season's prices only a small margin left over the value of $1 per ton for ore in the ground. That is about the current valuation of Lake ore as fixed in the transfer of the Hill ore lands to the Steel Corporation, and must probably be assumed in any future transaction. The day of leases at 25 cents per ton royalty has long gone by.

If the cost of transportation from Lake Erie to the furnace is added, the merchant furnace buying its ore must count on a cost of $4.50 to $5 per ton for its ore in all its calculations for the future. It is not likely that any future reductions will be made from the prices which prevailed during the past year of light demand. It is quite probable, indeed, that costs may increase; not, perhaps, in an advance of prices, but more probably in a decrease in the guaranteed iron content of the ores.

For the present—and for the future so far as can be foreseen—the furnaces of the North must depend largely upon Lake ores. A good deal has been said of the supply of Cuban ores. These, however, are available only on and near the seaboard, where they can be cheaply delivered by water. Moreover, the Cuban ores have become practically the property of two large steel companies, and are not offered for general sale, nor are they likely to be.

The cost of mining and delivering Lake ores must long continue to be a prime factor in the cost of steel; but the nominal selling price is, year by year, of less importance.

ACCORDING TO THE U. S. Geological Survey, the number of buildings erected in the United States in 1908 was 163,087, which cost $546,467,390. An investigation of this subject strikes us as being far from the domain of geology. The U. S. Geological Survey will better serve the mining industry by confining its attention to a study of the geology and the ore deposits of the country than by scattering its attention among miscellaneous subjects that belong to the general field of industry. The miners of the United States want more contributions of the character of the Leadville report and the establishment of more general principles, like secondary enrichment. They are not particularly interested in statistical investigation as to the cost of buildings, bridges, etc., nor the method of manufacturing shoes. At present the Geological Survey is not only missing the bull's eye, but also is failing, a good part of the time, to see the target at all.

May Dividends

In the acompanying table is shown the amount per share and total amount, of the dividends paid during May, 1909, by a number of mining and industrial companies in the United States and foreign countries.

	Location.	A'mt. per Share.	A'mt. Paid.
Amalgamated, c	Mont.	$0.50	$769,439
Bunker Hill & Sullivan, s.l.	Idaho	0.15	45,000
Calumet & Arizona, c.	Mich	1.00	200,000
Camp Bird, g.s.	Colo.	0.24	196,800
Homestake, g	S.Dak.	0.50	108,200
Inter'l Nickel, pf.	N. Y.	1.50	133,689
MacNamara, s.g	Nev.	0.01	7,283
Snowstorm, s.l.	Idaho	0.03	45,000
Lehigh Coal & Nav	Pa.	$2.00	$764,520
Buffalo	Ont.	$0.03	$27,000
Cobalt Central	Ont.	0.01	47,615
Dolores	Mex.	0.15	60,000
N.Y. & Hond. Ros.	C.A.	0.10	15,000
Right of Way	Ont.	0.10	49,951
Trethewey	Ont.	0.10	94,545

International Nickel Company

The report of this company for the year ended March 31, 1909, shows no change in the stock issued, the amounts being $8,222,662 common, $8,912,626 preferred, and $54,698 stocks of constituent companies not owned. The bonded debt was $9,296,837, a decrease of $55,000 during the year.

The income account for the year may be stated as follows:

Net earnings constituent companies	$2,162,594
Depreciation and renewal funds	$267,102
General expenses	139,393
Interest on bonds	473,500
Exhaustion of mines, etc	100,205
Sinking fund reserve	177,000
Reserve for foreign consolidated companies	30,599
Special depreciation reserve	200,000
Total charges	$1,387,799
Surplus for the year	$774,795

From this dividends of 6 per cent. on preferred stock, amountin to $534,733 were paid, leaving a balance of $240,$62. Adding $2,216,799 brought forward from previous year made a total surplus of $2,456,861 at the close of the year.

The report of President A. Monell says: "All construction work has now been completed, with the exception of repair shop and foundry at Copper Cliff. The payment of four quarterly dividends of 1½ per cent. each on the preferred stock was authorized by the board of directors out of the surplus earnings of the fiscal year, and they were all paid. The board has deemed it advisable to appropriate from the surplus a further sum of $200,000 to write down the cost of the properties, as set forth in the balance sheet. The last fiscal year followed as an aftermath of the panic of 1907, and brought with it all of the depressing conditions incident to such a state of affairs. Many of our customers worked their stocks up very close. As our sales are largely to steel manufacturers, they are susceptible to the influences which govern that industry.

"Energetic efforts which had been made in the introduction of the Monel metal commenced to bear fruit during last year, and the indications are that the production of this metal from our Creighton ores will be an important factor in the company's future operations and earnings. The American Sheet Steel Company, a subsidiary of the United States Steel Corporation, has taken up this metal vigorously. After a most severe test, the Pennsylvania railroad adopted this metal for the roof of its large terminal buildings in New York, and it has also been successfully used for propellers and many other purposes. While the tonnage is yet small, it is constantly and rapidly increasing."

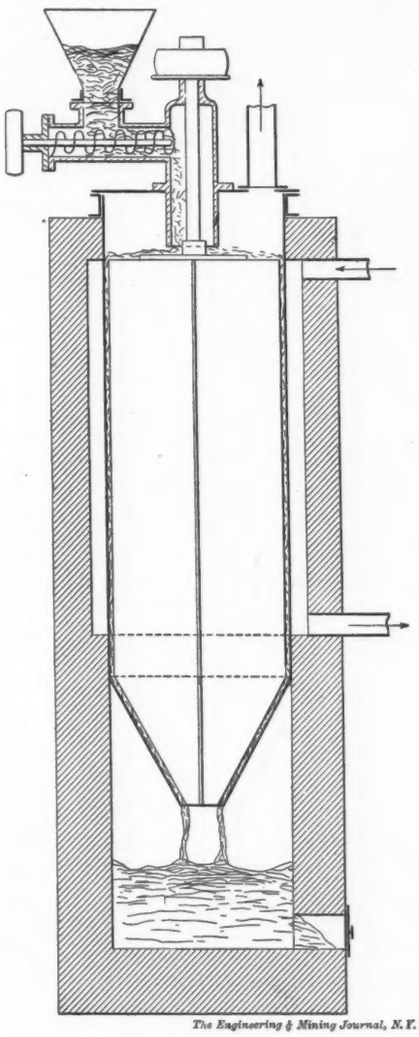
Utilizing Products of Detinning Processes

Dr. Hans Mennicke describes in British Pat. 16,248 of 1908, a process for preparing, smelting and utilizing various products containing tin, particularly the metallic sponge and slime obtained by the electrolytic removal of tin from tinplate scrap. The sponge is converted under water by stamp batteries or wet-ball mills into compact metallic lumps from which the alkali-lye is drawn. After the iron has been removed by magnetic separators, the lumps are smelted with carbon and soda, or other easily fusible salts, in externally heated crucibles, the contents of which are shut off from air. The soda or salt slag is ground and dissolved in boiling water, filtered, and the tin, dissolved as stannate, is precipitated from the liquid as oxide. The filtrate after being treated with lime can be used as soda lye, or sent back as electrolyte direct into the detinning process. Some of the new features claimed are, the obtaining of granular metallic tin and of raw tin free from iron, besides the possibility of completely condensing the flying dust and the recovery of volatile products.

The making of tinplates originated in Bohemia, according to a recent paper by William E. Gray, hammered iron plates having been coated with tin in that country some time before the year 1600. Tinplate making was introduced in England in 1665, the art being brought there from Saxony. In France the first tinplate factory was established in 1714. The first commercial manufacture of tinplates in the United States was at Pittsburg, in 1872; but the industry did not develop largely until after 1890.

Smelting a Pulverized Iron Charge

Carl G. T. de Laval, of Stockholm, Sweden, describes (U. S. Pat. 913,405, Feb. 13, 1909) a method for reducing iron from a finely pulverized charge of iron ore, carbon and slag-producing agents, the thin layer of the charge being brought in contact with a heated surface whereby



DE LAVAL FURNACE

the reduction is carried out. A vertical section of the apparatus employed is shown in the accompanying illustration. The pulverized charge from the hopper is fed to the center pipe by a screw conveyer, falls through the pipe to a rotating disk, which spreads it in a thin layer, and is then caught by vanes and thrown toward the hot wall of the shaft. The wall is kept hot by introducing hot gases in the space between the shaft and brickwork surrounding it. The charge gradually descends and the reduction takes place as the charge comes in contact with the shaft wall. The lower part of the shaft is funnel-shaped and opens into a chamber, where the reduced charge gathers.

Views, Suggestions and Experiences of Readers

Comments on Questions Arising in Technical Practice and Debatable Points Suggested by Articles in the Journal

CORRESPONDENCE AND DISCUSSION

Publicity in Buying Equipment

The importance of making full use of publicity when about to purchase electrical or steam machinery is often little realized by the man behind the check book. In dull times, of course, manufacturers' agents are so keenly alive to the importance of even small sales that the announcement that one is in the market for equipment immediately brings a flood of advertising matter and starts many interviewing salesmen toward one's office. To refuse to make the most of publicity at such a time is to neglect the widest field of selection, to throw aside the opportunity to buy most wisely, and frequently at the lowest terms. In prosperous times it is still more important to make one's prospective wants known early and over the entire field, since in this way quicker deliveries can often be obtained.

In entering the market for a number of motors of different size, for example, if a company simply writes a few letters to the manufacturing houses which naturally come to mind, the freedom of choice is bound to be somewhat restricted. It cannot be assumed that any one company or group of manufacturers enjoy a monopoly of all the best designing in the motor field, for improvements are constantly being made in machinery of this kind, and orders for special motors are always being filled. The larger the number of special machines developed, the wider is the choice available to the consumer, and the more likely it is that each particular engineering problem will be solved skilfully.

This is not an argument in favor of multiplying special designs, for there is often a tendency toward overdoing this phase of electrical and mechanical work. In reality, the purchase of a special type of motor by another consumer than the original buyer helps to standardize the type, and in most cases paves the way toward a lower market price. Similar points apply in the purchase of a steam engine. Here the question of speed is frequently one of great importance, and it is only by considering a wide range of propositions and sizes that machinery best adapted to the conditions of load and economy can be selected.

It is a matter of but a few moments to cast aside the propositions which are plainly inapplicable to the situation, and the man who fears to canvass the entire available market through an inexpensive notice in the press simply throws away some of his chances of obtaining the best technical solution of his problem. And it is a matter of dollars and cents in these times to do one's utmost to secure the most efficient machinery for the requirements.

Finally, the announcement that one is shortly to become a purchaser helps both the consumer and the manufacturer. If certain of the factories are hard pressed, the circulation of an inquiry through a wider field often enables the purchaser to secure one or more machines remaining in the hands of the dealers on account of the cancellation of a previous order, or else to select a machine of slightly different type which happens to be available. It is unquestionably true that the wider the range of the announcement of intending purchase, the better will be the deliveries secured. On his part, the manufacturer can do a much better business if he is forewarned as to prospective demands for his product. The cost of handling the order tends to decrease, since preparation can be made at the plant, if necessary, to turn out the apparatus more quickly and more economically. There is room for analysis in the economic relations of plant capacity, production conditions, and the times at which orders are received. The purchaser and the manufacturer each have much to gain by the practice of full publicity in approaching equipment selections.

H. S. KNOWLTON.

Newton, Mass, May 22, 1909.

Patenting Mining Claims

Doubtless every man appreciates the importance of the conservation of our natural resources, and none more than the mining engineer. He has seen the depletion of these resources by extravagance and waste but he knows, on the other hand, that the term waste is a relative one. Some of the methods of conservation, some of the lines that have been drawn about the uses of property, and interpretations that have recently been given existing laws are unreasonable and peculiarly irritating. These restrictions are a heritage from the Roosevelt regime, and much as we may admire that regime and appreciate some of its results, a sharp protest should be made.

I am thinking now particularly of the lines that have been drawn about the patenting of lode-mining claims. The attitude and procedure adopted by the land office in enforcing the requirements of mineral showings on lode claims prior to patent are such as must have an effect directly contrary to that intended by the law, and are making it doubly hard for the prospector or man of small capital to secure patent at all. The federal statute on this subject provides for the "location of mining claims upon veins or lodes of quartz or other rock in place bearing gold, silver, cinnabar, lead, tin, copper or other valuable deposits" and it states that "no location of a mining claim shall be made until the discovery of the vein or lode within the limit of the claim located."

Of course, the former custom of permitting a location to be patented with no investigation of the supposed mineral-bearing lode and no knowledge on the part of the proper officers of government of the facts as to whether or not there did actually exist upon the property any mineral bearing lode at all, was unnecessarily loose and careless. This has been gradually changed from time to time until now the requirements are as much too severe as they were too simple.

The present policy of the land office seems to be to enforce strictly the letter of the federal statute and to require clear proof that the discovery of a mineral-bearing lode in place within the lines of each location has been made, before issuing patent. In carrying out this policy each claim for which patent application has been made is inspected and reported upon by an officer of the land department before the claim is approved for patent.

Under the land-office regulations now in force, the country is divided into so-called field divisions, at the head of each of which is the chief of the field division, and the inspection of mining claims is made under his direction. When an application for patent is filed in the local land office steps are taken at once to have it examined and reported upon by an inspector. If within a forest reserve inspection is made by a forest supervisor, or by someone acting under his direction, and if not in a national forest it is examined by an inspector sent by the chief of the field division. In either case the inspection is controlled by the chief, and the report based upon it may be accompanied by recommendations from him. His attitude is, therefore, of importance.

Papers relative to the case are forwarded to the general land office at Washington. If the inspection and report are favorable patent issues without unusual delay, but if unfavorable the local land officers are apprised of the fact and send a notice to the mineral claimant specify-

ing the charges made against the issue of a patent. The claimant is then required to file, within thirty days, an answer under oath to these charges, denying them, or setting forth a state of facts showing them to be immaterial, and calling for a hearing. At this hearing the Government is represented by the chief of the field division, who acts in direct opposition to the claimant. This is not his province, for the Government should not, and probably does not, desire that the claimant shall be loser in the contest, or shall be made to struggle against the concentrated power of the United States, but that he shall have justice. The local land officers before whom the case is heard decide on the evidence, which is then subject to review by the general land office at Washington.

The land department is much more exacting in enforcing the requirement that a lode be discovered within the lines of the claim than it should be, than the laws intend it to be. Recent hearings all through the Southwest, and probably elsewhere, have established this fact. In one hearing of which I happen to know, the chief, who personally represented the Government, contended for the cancellation of an entry on the ground that "commercially valuable" copper had not been discovered on the claim. And yet, according to the decisions of the courts, the size of the lode and the value of its contents are immaterial except where the mineral claimant is opposed by an agricultural claimant, a townsite claimant, or some other applicant who seeks to have the land removed from the operation of the mining laws. In the case mentioned there was no such opposition.

A chief of a field division was recently taken over the surface of the Gardner claim of the Copper Queen Consolidated Mining Company at Bisbee, where is a deep shaft and from which many millions of dollars worth of copper have been taken, and where there are many more millions remaining in the ground. But there is no trace of a mineral-bearing lode in place on the surface. He stated, in all seriousness and with no realization of the absurdity of the position he was taking, that "if this claim should now come before me for review, I should be obliged to report unfavorably." And the Gardner claim is on the formation.

Take the case of a claim where the mineral-bearing formation is overlaid by some later rock, conglomerate, or something else. It would be impossible, under the present rulings, for the government agents to recommend a patent, even though geologists might be absolutely sure, by their observation or even by drill or other examination made underground, of the extension of the formation thereunder. All the Junction company ground at Bisbee, scores of claims in the Burro mountain region surrounded by productive areas, extensive tracts at Globe, and everywhere else, for that matter, that are proved mines would be impossible to secure, except by the sinking of a shaft into the formation and by sufficient exploration therein to determine to the satisfaction of these agents that a commercially profitable lode did actually exist there.

Where will the individual, the prospector, the poor man who is trying to develop and sell properties come out in such a case? He must give up and let some strong concern take up his lands and develop them. Such, I take it, was not the intention of the framers of the mineral laws of the United States. This extreme position taken by the land department now seems to be the rule everywhere. It is unwarranted, unjust, illegal and a distinct hardship to those who are trying to develop the mineral resources of the West.

DWIGHT E. WOODBRIDGE.

Duluth, Minn., May 17, 1909.

Slime Filtration

In the JOURNAL of May 15, 1909, appeared an interesting article on "Improvements in the Treatment of Slime by the Vacuum Filter Process," by Arthur W. Allen, of the Palmarejo & Mexican Goldfields Company, referring to certain innovations in connection with slime filtration. He has, however, omitted to say that the filter referred to is a Butters filter. The modification described illustrates one of many possible variations from the usual practice. We know of several modifications of the Butters filter that have been made by independent users and it might be of material help to the industry if others would follow Mr. Allen's example and make known interesting variations in the practice of slime filtration.

THE BUTTERS PATENT VACUUM FILTER COMPANY, INCORPORATED.

New York, May 20, 1909.

Rustless Iron

An interesting subject was touched upon by Mr. Cushman at the Iron and Steel Institute meeting recently held in this country; it was mentioned that in the past in India, the secret of nonrusting or nonoxidizing iron was known to skilled workers at that time, but has become a lost art to modern metallurgists. The monument at Delhi was mentioned, as an example for all time of the knowledge of those past masters in preventing iron from rusting, which at present is deplored as great wastage. Now we know India is famed for the purity of its iron ores ranging from the northern mountains of Kumáun to the extreme south of the Madras Presidency. The chief difficulty in smelting iron ores in India is that the three necessary elements, viz., the ore, flux and fuel, are not sufficiently near to each other. Another great drawback is the large amount of ash contained in the coal (over 20 per cent.) But returning to the rustless monument at Delhi and the process, of which those experts the Moors and the Hindus have held the profound secret, can any of the readers of the JOURNAL give any further details of this monument at Delhi? Has anyone experimented to prevent iron from rusting by furnace work, chemical treatment, etc? My own experience and experiments in this direction have resulted thus far only in retarding the oxidation.

D. O. LEWIS.

Swansea, May 19, 1909.

Electrolytic Production of Metallic Calcium

In British Pat. 24,396 of 1907, recently issued, S. O. Cowper-Coles describes an electrolytic process for obtaining calcium deposits upon one or more rotating disks of graphite or iron in proximity to the fused salt, such as calcium chloride, contained in a crucible at the bottom of which is a layer of molten metal preferably lead forming the anode connection. In the furnace the calcium chloride is first introduced into the calcining chamber, then passes into the fusing chamber, from which it flows in a molten condition to the crucible with the disks, these being rotated by electric motors or other suitable means. Mr. Cowper-Coles also proposes to use in the electrolytic separation of metals from fused salts a rotating cathode in the form of a disk immersed in the fused salt. This, however, would not be suitable for the production of metallic calcium, owing to the fact that the deposited calcium would be redissolved by the electrolyte.

In British Pat. 6029 of 1908, the Company Bismarckhütte describes a method of improving steel produced in electric furnaces. The steel previously refined in a basic electric furnace is passed into a crucible with an acid lining and allowed to settle. A mechanical readjustment takes place, the steel taking up silicon, and a favorable influencing of the internal structure of the steel is claimed. In addition it permits the production of iron alloys in a controlable manner, or the addition of modifying agents. The latter is accomplished by passing the unalloyed steel into the crucible before adding the modifying constituents.

The United States production of antimony ore for 1908, as shown by reports collected for THE MINERAL INDUSTRY, was 360 short tons as compared with 210 short tons in 1907; the value of the 1908 output $19,800, as compared with $28,432 for 1907.

The Analysis of Oklahoma Blendes

By L. T. Merrill*

The ordinary methods of zinc-ore analysis are not applicable to the ores of the Miami district because of the variable results produced by the bitumen and natural oil which is never absent. Until this was recognized and the proper remedy applied the chemists of the Joplin district were wont to report results of such great variability that they were frequently bewildering.

The first two cars of this ore analyzed by our laboratory (September, 1908), gave the following results: No. 1, sellers' analysis, 44.7 per cent. zinc, 3.6 iron; buyers' analysis, 42.6 zinc, 7.7 iron. No. 2, sellers' analysis, 44.8 zinc, 2.7 iron; buyers' analysis, 45.1 zinc, 4.5 iron. This made a difference of $6.20 and $2.10, respectively, on every ton of ore. I may say here that any difference in analyses over $1 per ton is not ordinarily tolerated.

A series of analyses run on these two samples was only negatively successful, the results varying to such an extent that it was evident that something, most probably the method, was at fault. An exhaustive complete analysis showing no striking dissimilarity between these and other ores of the Joplin district which caused no trouble, the bitumen and oil was evidently the disturbing factor.

To get rid of this oil was naturally the first expedient. The weighed charge was slowly brought to a red heat in a porcelain crucible, cooled, transferred to a flask, and the analysis carried out by the usual method. The results were most startling; all irregularities ceased, the results checking closely, but in every case the iron percentage obtained was higher than that shown previous to the preliminary heating, the difference being generally from 1 to 5 per cent. The irregularities in the zinc analyses ceased, but no very marked differences were manifest.

Subsequent investigations have shown that the oil and pitch surround particles of the ore (chiefly the marcasite and pyrite) and prevent reduction by the acids. This roasting method has since become almost general throughout the Joplin district and with uniformly good results. The following is a brief description of this method as practiced in our laboratory:

Scheme

The ore ground impalpably fine in an agate mortar, is weighed into a porcelain crucible of about 20 c.c. capacity; in this it is brought very slowly (to avoid any decrepitation) to a low red heat. The crucible and contents are then cooled and the ore transferred to a "copper determination" flask of about 200 c.c. capacity by means of a small camels'-hair brush. Decomposition of the ore is effected by 8 c.c. of 1:1 hydrochloric and nitric acid. When complete, 3 to 4 grams of chemically pure ammonium chloride are added and the contents allowed to boil until intumescence occurs; 50 c.c. of hot water is then added and when all is in solution, 7 c.c. of ammonia. The contents are brought to a brisk boil, then filtered into a No. 3 beaker.

The ferric hydrate, etc., is well washed on the filter with a hot dilute solution of ammonium chloride. After thorough washing the ferric hydrate is dissolved with 1:5 hydrochloric acid into the original flask through the filter, the filter washed, the iron precipitated with 5 c.c. ammonia and boiled and the filtering repeated. The filtrate is then acidified with 15 c.c. hydrochloric acid, warmed and titrated with standard $K_4Fe(Cu)_6$ solution.

The chlorides are washed from the precipitate of ferric hydrate, which is then dissolved into a clean flask with 1:5 sulphuric acid; a few grams of granulated zinc are added, the contents brought to a boil, taken off, allowed to stand until the zinc is all dissolved, and the solution cold. Then titrate with standard $KMnO_4$ solution.

*Chemist, Cockerill Zinc Company, Webb City, Mo.

Finished Iron and Steel Production

The American Iron and Steel Association has just published statements of the production of finished iron and steel in 1908, which serve further to show the trade depression of the year. The production of rolled iron and steel in various forms is given below, in long tons:

Products.	Iron.	Steel.	Total.
Rails	71	1,921,540	1,921,611
Structural shapes	2,423	1,080,758	1,083,181
Plates and sheets	54,033	2,595,660	2,649,693
Nail plate	15,482	30,265	45,747
Wire-rods	509	1,816,440	1,816,949
Rolled forging blooms and forging billets	282	121,039	121,321
Merchant bars	685,233	1,301,405	1,986,638
Skelp, flue, etc	297,049	853,534	1,150,583
Splice-bars	10,502	81,308	91,810
Hoops	1,000	169,860	170,860
Bands and cotton-ties	293	238,148	238,441
All other	171,572	380,383	551,955
Total	1,238,449	10,590,340	11,828,789
Total, 1907.	2,200,086	17,664,736	19,864,822

Of the plates and sheets reported last year 1,271,021 tons were classed as plates, being No. 12 gage and thicker; 1,378,672 tons were sheets, No. 13 gage and thinner.

While exact figures cannot be given, as the two reports are in different forms, it is approximately correct to say that the United States Steel Corporation last year produced 55 per cent. of the total finished iron and steel made and sold.

The total decrease in rolled products last year was 8,036,033 tons, or 40.5 per cent. The production of rails has been heretofore given in detail.

Nails

The production of nails of all kinds for two years past was as follows, in kegs of 100 lb. each:

	1907.	1908.	Changes.
Cut	1,109,138	956,182	D. 152,956
Wire	11,731,044	10,662,972	D. 1,068,072
Total	12,840,182	11,619,154	D. 1,221,028

All the wire nails and 646,062 kegs of the cut nails were made from steel. Last year wire nails were 91.8 per cent. of the total, and cut nails 8.2 per cent.

The nail make showed a much smaller decrease than any other form of steel, except tinplates.

Tinplates

The production of black sheets and of finished tinplates and terne-plates is reported as below. The black sheets are the plates rolled for coating with tin. The figures are in long tons:

	1907.	1908.	Changes.
Black plates	504,072	513,771	I. 9,699
Finished:			
Tinplates	444,933	468,257	I. 23,324
Terne-plates	69,842	68,829	D. 1,013
Total	514,775	537,086	I. 22,311

Of the black plates rolled in 1908 only 2954 tons were of iron. Tinplate production was the only form of iron or steel which showed increased production last year.

Charcoal Iron Blooms

The production of iron blooms, billets and bars in charcoal bloomaries from pig iron or from pig iron and scrap, for the consumption of the makers or for sale, amounted in 1908 to 55,973 tons, against 84,623 tons in 1907 and 94,999 tons in 1906. The charcoal iron blooms, slabs, etc., produced in 1907 and 1908 were made in Pennsylvania, Maryland, Kentucky and Ohio. In 1906 these products were made by these four States and Delaware. Charcoal iron blooms are chiefly used in the manufacture of skelp for boiler tubes and in the manufacture of black plates for terne plates. About four-fifths of the annual production is consumed by the makers.

Forges for the manufacture of blooms and billets from iron ore have not been in operation in the United States since 1901, in which year the blooms and billets so made amounted to 2310 gross tons, all made in the State of New York. All the Catalan forges in the United States have long been abandoned.

The only charcoal blast furnace in England is at Backbarrow in Cumberland. It was recently relined and repaired, and went into blast again early in May. It has been in operation over 60 years.

New Publications

HIGH-TENSION UNDERGROUND ELECTRIC CABLES. By Henry Floy. Pp. 135, illustrated. 5x7½ in.; cloth, $2. New York, 1909: Electrical Publishing Company.

SANITATION AND SANITARY ENGINEERING. Revised Edition. By William Paul Gerhard. Pp. 174. 5x7½ in.; cloth, $1.50. New York, 1909: Published by the author.

THE MANUFACTURE OF EXPLOSIVES. Twenty Years' Progress. By Oscar Guttmann. Pp. 84, illustrated. 6x9 in.; cloth, $2. New York and London, 1909: Whittaker and Company.

SECOND REPORT ON THE CLAY DEPOSITS OF GEORGIA. By Otto Veatch. Geological Survey of Georgia, Bulletin No. 18. Pp. 453, illustrated. 7x10 in.; cloth, Atlanta, Ga., 1909: Geological Survey of Georgia.

INVESTIGATIONS OF THE COALFIELDS OF WYOMING BY THE UNITED STATES GEOLOGICAL SURVEY IN 1907. By J. A. Taff, E. W. Shaw, C. W. Washburne, E. G. Woodruff, E. E. Smith, M. W. Ball and A. R. Schultz. U. S. Geological Survey, Bull. No. 341B. Pp. 282, illustrated. 6x9 in.; paper. Washington, 1909: Government Printing Office.

THE RHODESIAN MINER'S HANDBOOK. Revised Edition. By F. P. Mennell. Pp. 167, illustrated. 5¼x8½ in.; cloth. Bulawayo, Rhodesia, 1909: Ellis Allen.

Contents: Geological formations. The origin of ore deposits. Character of orebodies. Prospecting, etc. Work with the blowpipe. Precious metals. Base metals, etc. Precious stones. Coal. Working notes.

ALLOYS AND THEIR INDUSTIAL APPLICATIONS. By Edward F. Law. Pp. 269, illustrated. 5½x9 in.; cloth, $4. Philadelphia, Penn., 1909: J. P. Lippincott Company; London, Charles Griffin & Co., Ltd.

Contents: Properties of alloys. Methods of investigation. Constitution. Influence of temperature on properties. Corrosion of alloys. Copper alloys (bronze). Copper alloys (brass). Copper alloys (special bronzes and brasses). German silver and miscellaneous copper alloys. White metal alloys, lead, tin and antimony. Antifriction alloys. Aluminum alloys. Silver and gold alloys. Iron alloys. Miscellaneous alloys.

PRINCIPLES OF MINING. By Herbert C. Hoover. Pp. 199, illustrated. 6x9 in.; cloth, $2.50. New York and London, 1909: Hill Publishing Company.

Contents: Valuation of copper, gold, lead, silver, tin and zinc lode mines. Development of mines. Stoping. Methods of supporting excavation. Mechanical equipment. Ratio of output to the mine. Administration. The amount of risk in mining investments. The character, training, and obligations of the mining engineering profession.

This book is appropriately entitled the "Principles of Mining" because it deals with the fundamentals of the art from the economic standpoint, and that, of course, is the only reason why mining is prosecuted at all. The great treatises that discuss in detail the technics of the art concern themselves with the means how. Mr. Hoover treats broadly of the means how, but confines himself chiefly to the reasons why, and so far as we are aware he is the first author to take up that elemental phase of the subject. It has been done, of course, in a fragmentary way in contributions to the technical press and the proceedings of the societies, but no one previously has elaborated a treatise upon it. It is singularly fortunate that Mr. Hoover should be the first to elect to do so, because we can conceive of no one else so thoroughly competent. He is so well known in the profession and in the industry at large that it is unnecessary for us to expand respecting his capacity. It is sufficient for us to say, and this merely for the information of the laymen, that he is not only eminent as an engineer, but also as a manager of mining enterprises of the first magnitude in many parts of the world. The profession and everyone interested in the mining industry are to be congratulated that he has taken the trouble to write this book.

BUILDING CONSTRUCTION AND SUPERINTENDENCE. Part I, Revised Edition. By F. E. Kidder. Revised and enlarged by Thomas Nolan. Pp. 965, illustrated. 7x10 in.; cloth, $4. New York, 1909: William T. Comstock.

Contents: Foundations on firm soils. Foundations on compressible soils. Masonry footings and foundation walls. Shoring and underpinning. Limes, cements and mortars. Building stones. Cutstonework. Bricks and brickwork. Architectural terra-cotta. Fireproofing of buildings. Concrete and reinforced concrete construction. Iron and steel supports for masonwork—skeleton construction. Lathing and plastering. Specifications.

It is unnecessary for us to enter into any description of this well known work, which for many years has been a classic among architects, engineers and builders. It was Mr. Kidder's intention to publish a thoroughly revised edition, but personally he was unable to undertake it. Shortly before his death he expressed the wish to his friend, Thomas Nolan, assistant professor of architecture in the University of Pennsylvania, that he should do it. In carrying out that wish Professor Nolan endeavored to bring it down to the present day in such form that it will continue to hold a high place as one of the standards of the best contemporary practice in the elements of architectural masonry construction and superintendence. In the execution of that idea he has been entirely successful. There has been an entire revision, and many new chapters have been supplied. The book will continue to hold its place as a classic, with the additional advantage of being thoroughly uptodate. Of course, it is a work that no architect or builder can afford to be without. We may add that it is of the highest importance to constructing engineers in general practice, many of whom do not possess the acquaintance with it that they ought.

CRELLE'S CALCULATING TABLES. New Edition. By O. Seeliger. 10x15 in.; cloth, $4. Berlin, 1908: George Reimer.

This book is useful chiefly for tabular computation where many numbers are to be multiplied by the same factor. It gives directly, without further calculation, the products for the multiplication of every two numbers from 1 to 1000, quotients up to 1000, obtained from divisions, and the application to multiplication and division of all numbers above 1000. Methods are given for readily obtaining square, cube, and biquadratic roots. The tables enable procedure with three figures at a time, in obtaining roots, instead of with one at a time, as in ordinary calculating. Each page contains 2000 products, i.e., those of each of the two factors at the top of the page with all numbers from 1 to 1000. In multiplication the hundreds of the second factor are found along the same horizontal line as the first factor, at the top of the page. The tens and units in a column to the left of the page. The product is found by following down the hundreds column to the horizontal line of the tens and units. The last two figures are placed apart in the last vertical column to the right of the page, as they are the same for all products given on the same line.

In dividing, the nearest product below the one given is found on the page of the other number. (One of the numbers is considered as the dividend, the other as the divisor.) The heading of the column under which the product is found gives the hundreds of the quotient and tens and units are found on the same horizontal line, in the last column to the left of the page.

These tables have been rearranged so as to be much more convenient and so as to minimize the chances for errors entering the work. Originally the tens-multiples of any factor were omitted. These have been supplied in the present publication so that products of all multiples of tens can be directly read off. Other alterations have been made to make the tables more complete and easy of manipulation. They are of great use to engineers and others who have to make many computations. The price is surprisingly cheap considering the magnitude and character of the work.

Devices for the Prevention of Overwinding

Several efficient combinations of throttle-closing devices and automatic brakes have been invented and patented by the Sullivan Machinery Company. Where these are in use, writes S. T. Nelson, superintendent of the Chicago Works of the Sullivan company, in *Mine and Quarry*, a dangerous overwind is practically impossible. Someone not familiar with these devices may ask the question, "In case of a lower boiler pressure than that for which the hoist in intended, if the throttle is closed at the same point as it would be closed if the boiler pressure were higher, will not the engine come to a standstill before the landing is reached?" Regarding this, it should be explained that after the main throttles are automatically closed the engineer cannot reopen them until the engine is reversed. Should it be necessary to admit more steam to the cylinders a small bypass throttle is provided for this purpose, connected with the operator's platform by means of a hand lever or foot treadle. From this small throttle the steam is conveyed to the main cylinders through a pipe varying from 1 to 2 in. in diameter according to the size of the machine, and a sufficient amount of steam is admitted to the cylinders to complete the lift without increasing the speed of the engine beyond one at which the automatic brake can safely be applied. The automatic closing devise is so adjusted that with the heaviest boiler pressure and the lightest load the engine will come to a standstill, or nearly so, before the point is reached where it is desired to apply the automatic brake and stop it entirely.

The bypass throttle is also very convenient to use instead of the main throttles when hoisting officers and miners or examining the shaft. Due to the small size of the bypass throttle and the small amount of steam admitted through it, a large hoisting engine can be much more conveniently controlled with it than with the large throttle.

The automatic throttle-closing device is not only a means of safety, but a means of economy as well. A great many hoisting engineers will not shut the throttle until late in the trip, at least part of the time. The hoist is then running at such a speed that the brake has to be applied to arrest the momentum long before the landing is reached, whereas had the throttles been closed several revolutions earlier that much steam would have been saved, instead of being wasted in the neutralization of its energy by the brakes.

Several instances are recorded in which the hoisting engineer has come up to a level, taken on a load and, by mistake, reversed the engine and lowered the load, instead of hoisting it. The down-going skip pulled the engine backward at full speed, with the steam admitted to the cylinders in the same direction, thus acting with gravity, instead of against it.

But even though the speed of the machine was controlled by the down-going weight and not by the steam, the automatic brake was applied, and with the exception of breaking a part of the overhead sheave, no damage was done. Had not the automatic brake gone into action the loaded down-going skip would have shot the empty up-coming skip through the top of the shaft house.

Salt Production with Exhaust Steam

By Norman B. Beasley*

There is now going on in the salt industry, especially in Michigan, a transformation almost as radical as occurred when Michigan lumber first brought out Michigan salt. It is a change from the saw-mill system of producing salt, in which fuel economy was no object, to a time that is almost here when fuel will be the main consideration. Much of the future salt supply of this section is destined to come from mineral fuel, in which case its cost directly becomes an important factor in the salt production, or indirectly, as in the case of a salt works using exhaust steam from a manufacturing plant. Either of these situations forces upon the salt producer a realization of the fact that steam costs money. Economy and efficiency then become important factors.

Steam economy and evaporative efficiency are subjects that are always of interest and there is a relatively small amount of literature on the subject of brine evaporation available for general reference. To secure reliable data on this subject, George B. Willcox, of the Willcox Engineering Company, Saginaw, Mich., made a number of evaporative tests on salt-producing apparatus of different kinds. Some of these tests were made on salt grainers. The objects of the test were: (1) To determine the amount of steam required to produce a barrel of salt—280 lb.; (2) to record, for future reference, the variations in temperature of the brine as evaporation proceeded; (3) to ascertain the amount of brine required to make a barrel of salt; (4) to record the fluctuations in steam pressure, pressure of the atmosphere, temperature of the air above the grainer, and temperature of the outside air in order to show, if possible, the effect of these items on the economical production of salt.

No attempt was made to secure especially favorable conditions, the plant being run during the test exactly as the salt maker had been accustomed to run it. The salt was obtained from a natural brine and the steam for the salt plant was exhaust steam from a factory, the pressure averaging 1.6 lb. per sq.in. and containing 3 per cent. moisture. The test was divided into eight intervals as shown in the accompanying table. The rate of condensation was at first rapid and fluctuated considerably for the first 9 hours at which time the salt was being raked out. The rate of condensation for the next 37 hours, period No. 2, was approximately uniform, but changed to a different rate, which was substantially followed for the ensuing 53 hours.

BRINE EVAPORATION WITH EXHAUST STEAM.

Period.	Hours.	Salt, Pounds.	Steam, Pounds.	Pounds per Hour.		Pounds Steam Required to Produce One Pound Hot Salt.
				Salt.	Steam.	
1	9	.....	26,320	....	2,924	.....
2	37	25,297	91,354	684	2,466	36.05
3	53	32,968	110,570	623	2,086	33.48
4	17½	11,783	39,396	673	2,245	33.36
5	34½	20,896	69,286	605	2,008	30.1
6	4	2,468	7,594	617	1,898	30.76
7	24	10,640	45,452	443	1,477	31.8
8	13	6,900	24,040	531	1,849	34.9

By comparing the total steam condensed in any period with the total salt produced in that period, we obtain the pounds of steam required to produce a pound of salt during a given period. Knowing the cost of the steam we can find the cost of producing a pound of salt during each of the given periods, and an analysis of the conditions existing during that period gives us an insight into the conditions required for economical production. There were many variable conditions, such as specific gravity of the brine, changes in ventilation in the grainer room, agitation of the brine surface, and depth of brine above the grainer pipes. These data are not available at the present time but a study of the general results given in the table will perhaps prove illuminating.

The 1908 production of fine silver in the United States, according to figures of The Mineral Industry, only amounted to 51,798,053 oz. ($27,382,523) against 56,514,700 oz. ($36,919,358) in 1907. The low price of the metal in 1908 curtailed the output.

*Detroit, Mich.

Personals

Mining and metallurgical engineers are invited to keep THE ENGINEERING AND MINING JOURNAL informed of their movements and appointments.

C. Colcock Jones has been at Manhattan, Nev., examining placer ground for Los Angeles people.

Frank Huntziker is now connected with the office of Victor Rakowsky, at Duluth, Minn., as associate enineer.

Victor Kerr has been appointed superintendent of the Gold King Mining Company at Silverton, Colorado.

Eli T. Conner has opened an office in the Real Estate Trust building, Philadelphia, Penn., as consulting mining engineer.

D. M. Haynes, of Golden, Colo., has gone to Yucatan, Central America, to look over mines in the interests of eastern people.

J. H. Robeson has been appointed general manager of the Dives-Pelican and Seven-Thirty mines at Silver Plume, Colorado.

J. A. Whittier, manager of the Goodenough mine, Slocan, B. C., has returned to Nelson, B. C., from California, where he spent the winter.

Burr & Fergusson, civil, hydraulic and mining engineers, have opened offices in the Loo building, Hastings and Abbott streets, Vancouver, British Columbia.

William E. Miller, secretary of the Arizona Copper Company, and George Richmond, one of the directors, are in Clifton, Arizona, inspecting the work of the company.

Herbert Haas has left San Francisco for Salt Lake City in reference to his sintering process, and will continue his trip to Cleveland, Ohio. He expects to be gone for at least a month.

James Cronin, of Spokane, Wash., formerly manager of the St. Eugene lead-silver mine, East Kootenay, has gone north to develop a mining property in the Babine mountains, Skeena River district of British Columbia.

Arthur C. Fox has resigned as representative of the fee-owners of the Silver mine at Virginia, Minn., and has left for Clealum, Wash., where he has accepted the position of superintendent of the Duluth-Pacific Copper Company.

W. W. Keefer, recently with the Monongahela River Consolidated, has been appointed vice-president and general manager of the Pittsburg Terminal Railroad and Coal Company, and will have charge of all the coal-mining operations.

Samuel M. Robins, for years superintendent of the New Vancouver Coal Mining Company's collieries in the Nanaimo district, Vancouver island, B. C., is now living at Ilfracombe, Devonshire, England, and has much improved in health.

Charles S. Witherell, formerly superintendent of the copper department, Perth Amboy plant, American Smelting and Refining company, has been appointed to similar position with the Balbach Smelting and Refining Company, Newark, New Jersey.

Victor Rakowsky has been superintending concentrating tests at Dallas, Tex., and from that point left for the Cascade mountains. Wash., and Butte, Mont., for the purpose of examining mining properties. He will return to Duluth, Minn., about the middle of June.

James S. Douglas, for a number of years connected with the Phelps-Dodge interests, has resigned the position of manager for that company in Sonora, Mexico, and will be succeeded by J. S. Williams, Jr. Mr. Douglas has built a house in Douglas and will move to that city from Nacozari, his intention being to spend a year in traveling, during which he will visit the principal copper mines of the world.

Hon. Edgar Dewdney, of Victoria, B. C., who was engineer in charge of the work of making a road much used by Cariboo pioneers and the trial from Hope, on the Fraser river, to Wild Horse creek, the scene of another important gold rush nearly half a century ago, recently celebrated the jubilee of his arrival in British Columbia from England. Beside having been associated with much pioneer work in connection with placer gold mining, Mr. Dewdney has served as a member of the Dominion government, and has been lieutenant-governor of the Northwest Territories and of British Columbia.

Obituary

Major J. R. Graham, of London, England, technical adviser for the East Tilbury (Canada) Oil Fields, Ltd., died suddenly at Chatham, Ont., May 26. Prior to entering the oil business, Major Graham saw active service with the British Army, subsequently becoming British military attache at Washington.

Francis X. Pund, vice-president of the D. T. Williams Valve Company, Cincinnati, O., passed away at his home, after a brief illness, Saturday morning, May 8, aged 57 years. He was born in Cincinnati and after service with several firms, in 1904 he entered the manufacturing business and with David T. Williams, founded the D. T. Williams Valve Company. Mr. Pund was a prominent member of various business organizations in which he took a great interest.

George C. Edson, who died suddenly at St. Albans, Vt., May 21, was recognized as an authority on geology and studied particularly the Cambrian division. Only recently he discovered what is called Middle Cambrian in Vermont, with many fossils not before found in the State. He had long been in correspondence with the Smithsonian Institution and United States Geological Survey. He had been engaged for years under the direction of Professor G. H. Perkins, State geologist, in studying and writing of the geology of the upper part of the State.

Societies and Technical Schools

Lackawanna Chemical Society—This association held its monthly meeting May 25, in the new laboratory of the Delaware, Lackawanna & Western Railroad, at Scranton, Penn. This building, with its fixtures, will have cost about $40,000 when complete in detail. Testing machines for metals, cement, wood and rubber hose are in place including a Reihle 200-000-lb. machine. There are fine soapstone topped chemical benches on the second floor, with a complete system of hoods, and other methods of ventilation. The Lackawanna finds that it pays to test boiler water, fuels, oils, cement, metals, paints and almost all supplies purchased in large quantities.

American Society of Engineering Contractors—This organization has a membership of about 1500, scattered over the United States, Canada and Mexico. The object is to assist engineers and contractors to better the conditions under which they work, to establish a high professional standard, obtain better contracts and specifications and to bring together on a common ground engineers, contractors and the manufacturers of engineering tools and equipments. The following officers have been elected for 1909: George A. Jackson, Chicago, president; Halbert P. Gillette, New York, first vice-president; D. E. Baxter, New York, second vice-president; Daniel J. Hauer, New York, secretary; Prof. Alex. Haring, New York, treasurer.

Coal Mining Institute of America—The summer meeting will be held at Punxsutawney, Penn., June 29-July 1. The following papers are promised:

Address of Welcome, A. W. Calloway; "The Safe Use of Electricity in Mining," George R. Wood, Pittsburg; "Clay Mining and Its Relation to Coal Mining in Central Pennsylvania," R. R. Hice, Beaver, Penn.; "The Sociological Side of Coal Mining," C. Rae King, Crabtree, Penn.; "Mine Inspection with Respect to Car Allotment," H. B. Douglas, Philipsburg, Penn.; "The Preservation of Mine Timbers," John M. Nelson, Jr., Washington; "European Coal Mines, J. W. Paul, Pittsburg; "The Heat of Coke Ovens," J. R. Campbell, Scottdale, Penn.; "Methods of Bringing Down Coal Other than by Blasting," William Seddon, Brownsville, Penn. Wednesday June 30 visits by special train to mining plants in Indiana and Armstrong counties have been arranged.

Special Correspondence from Mining Centers

News of the Industry Reported by Special Representatives at San Francisco, Butte, Denver, Indianapolis, Salt Lake City, Johannesburg

REVIEWS OF IMPORTANT EVENTS

San Francisco

May 26—The phenomenal success of quartz miners at Alleghany, Sierra county, within the past two months has been such as to attract the attention of mining communities in all the Pacific Coast States. Large numbers of men have gone to that section prospecting and trying to buy old properties or prospects. The region has been worked for nearly 60 years, though it has never been placed where capital has done much. Indeed, the location is to a certain extent an isolated one, there being no railroads anywhere near it, and not even good wagon roads. As a result the miners who have worked there for years have made comparatively little development as far as deep mining is concerned, and a large number of discovered prospects have remained prospects for years, until now they have taken on a value owing to the finds in several of the mines which have been properly worked. A year or more ago the finding of a large body of exceptionally rich ore in the Tightner mine, owned by H. L. Johnson, first called attention to the possibilities of the Alleghany section. Men who have gone in there since have discovered even richer and larger orebodies than those of the Tightner. Capitalists from all directions are trying to get hold of such available claims as they can. It is a Colorado man, E. H. Wilson, who has developed the richest mine of the section—the Sixteen-to-One—from which he took some $400,000 in six weeks after the discovery in the tunnel on April 1, and the mine is still yielding largely. Mr. Wilson makes no secret of the mine's production as it is not for sale and he owns most of it.

Within the past two weeks other strikes of magnitude have been made in the Alleghany section. H. L. Johnson, owner of the Tightner, bonded the El Dorado two weeks since, and a few blasts in specimen rock loosened between $50,000 and $60,000 worth of gold ore. The Morning Glory mine, near by, owned by Rohrig Brothers, has broken into rock of immense value, some $70,000 being taken out in a few days. The Rainbow mine at the same place, L. P. Woodbury, manager, has struck "jewelry" rock also. In this property they expect to cut the Tightner vein in their tunnel within a week. As may be supposed, these developments have had the effect of starting up work on a number of old and new properties in the vicinity. Not only that, but other parts of Sierra county are sharing in this prosperity. The Bonanza King, a Southern Sierra property near the Middle Yuba river, has begun shipping very high-grade ore to the smelter. Ole Johnson, of Mountain House, a few miles from Alleghany, has unearthed a rich surface pocket. The Chipps mine above Sierra City is again in bonanza ore. San Francisco men, represented by F. M. Phelps, have bonded the West Point mine, seven miles from Downieville, and are opening it. The White Bear drift mine, seven miles from Downieville, has broken into high-grade gravel. The manager, John Costa, has found deep blue gravel which pans freely. The old Alaska mine, at Pike City, after five years' struggle against water, now has it under control with the big electrical pumps. The crosscut from the bottom of the new 580-ft. shaft is expected to cut the long-sought ledge soon. Manager George St. John has his mine now well equipped. The Keystone company at Sierra City has been reorganized by W. H. Perryman, T. C. Batting and others as leasers, and the mine is being worked again. The old Cleveland mine, between Sierra City and Downieville, has been bonded to John W. Shinn, of Pelham Manor, N. Y., and is being started up.

Had any of these strikes occurred in one of the southern Nevada mining camps there would have been a "rush" and wild excitement on the stock exchanges. But none of the California mines are listed on the stock boards, so that little is said in San Francisco papers about what is being done in Sierra county.

The strike of miners in Amador and Calaveras counties, over the eight-hour law, and the enforcement of the provision adopted by mineowners that men must work eight hours "at the face," at one time last week threatened to become serious. In Amador county particularly, many miners quit work. Agents of the miners' unions came to Jackson where the big mines are, and endeavored to force the employers to come to their terms, but without success. The strike has finally been settled according to terms offered by the mineowners and the men have gone back to work on the new schedule by which they use their own time, not the owner's, in going to and coming from the place they work in the mine. One of the big companies started to sell its supplies and timbers and the miners feared a general shut-down of the other properties. After consultation they decided to accept the owners' offers. The same thing occurred in Calaveras and other counties, so that it looks now as if the mineowners had won their point. No test case, however, has yet been commenced.

The tramline of the Balaklala Copper Company at Coram has been again started up and is delivering 500 tons of ore daily to the smelter. The wreck of the ore bunkers stopped matters for a month or so but the mine is again at work with 225 men on payrolls. The bulk of the fluxing ores for the smelter comes from Nevada, though some is mined at the Reid property in Shasta county.

W. S. Fletcher and associates, of Los Angeles, who have bonded a number of gravel properties on the Forest Hill and Michigan Bluff divides in Placer county, have commenced development work on them. At the Home Ticket, near Last Chance, 20 men are working on the channel. Work has begun on the Red Sea mine in Devil's Cañon and the Paragon drift mine near Forest Hill. Several of these mines are on gravel channels of proven richness but have laid dormant for want of capital to run the necessary bedrock tunnels. They are all drift properties.

The Mose Rogers group of mines in Quartzburg district, Mariposa county, has been bonded to New York men through James F. Peck of San Francisco. They include the Washington, Franklin, Jenny Lind, No. 9, Quartz Mountain, Pool and several others. Some of these mines have been large producers and some are equipped with hoists, mills, etc. After necessary repairs the power will be obtained from the Exchequer company's electric plant on the Merced river. The mines are near Hornitos.

The Anti-Débris Association is afraid that the laws against hydraulic mining are not being obeyed, because they find that the miners are making efforts to keep the watchmen or "spies" away and keep themselves posted by telephone or otherwise when a watchman is likely to come to their neighborhood. In Placer and Nevada counties notices have been conspicuously posted, meant chiefly for the Anti-Débris watchmen. The "warning" states: "You are now on private property and amenable to law as a trespasser. Retrace your steps as speedily as possible or you will be roughly handled and subject to arrest. We are not hiring any help and do not want any sightseers. Get out and stay away. These orders will be enforced by local police officers and a detective agency."

Butte

May 26—News comes from New York that J. G. White & Co., of that city have underwritten the $2,500,000 bond issue of the Butte & Helena Electric Railway Company, recently formed for the purpose of constructing an electric line between Helena and Butte. It is probable that work on the construction of the line will be begun immediately.

J. W. Murphy, Jessie S. Murphy, Duncan McRae and Margaret McRae have instituted action in the local district court against J. M. Kennedy and Maurice Eisenberg for the recovery of 20,000 shares of stock of the Butte Hill Copper Mining Company. In the complaint it is alleged that the defendants received the stock for use in promoting the company but that they have failed to use the stock for that purpose and have converted it to their own use. Certified articles of incorporation of the Montana, Idaho & Pacific Railway Company have been filed in the office of the county clerk of Missoula county. The company is an Idaho corporation with a capital of $16,000,000 and was organized for the purpose of constructing a road from Lapwai Junction, Idaho, to Butte, via the Lolo pass of the Bitter Root mountains.

The annual report of the Anaconda Copper Mining Company for 1908 has recently been made public. In the report it is stated that 64,869,176 lb. of copper were produced as compared with 63,055,661 in 1907. The mines were not opened until March, 1908, and the expenses incident to the reopening were such that there was a deficit during the first six months of the year. It is stated that considerable difficulty was experienced with the mine fires in the Anaconda, St. Lawrence and Never Sweat mines but that the completion of the Belmont shaft will increase the facilities for mining the ores of those mines without interference by the fires. The report further states that long term contracts have recently been closed by which electric power for use in the Butte mines will be secured at low rates.

A decision of great importance to every locator of a mining claim within the boundaries of a national forest was delivered today by Register Miracle and Receiver Freeman in the case of the United States against Joseph Garneau and Louis Hickey, and is in favor of the defendants. This is the first case of the kind which the officials of the Helena land office have ever passed upon, and in the decision some important principles are enunciated.

Garneau and Hickey located quartz claims within the boundaries of the Elkhorn division of the Helena national forest, and charges were brought against each location, alleging that there had been no discovery of mineral in rock in place. The results of samples taken by the Government expert did not come up to the standard which he considered necessary to constitute a location.

Denver

May 28—A few years ago a pyritic smelter was erected at Golden by Dr. Carpenter, and affiliated with it at that time was the Saratoga mine of Gilpin county. From the smelter great things were expected by the producers of pyritic ore in Gilpin and Clear Creek counties; but after a short and uneventful career, it was compelled to close down. Later a new company was formed, and the smelter once more placed in blast, with abundant promises from producers of pyritic ore to keep the plant amply supplied, notwithstanding competitive rates that might be established by the American Smelting and Refining Company. The producers, however, allowed the pyritic smelter to fall short of ore, and it was again closed. The North American Smelter and Mines Company, organized under the laws of this State, has now secured the above plant, and expects to have it in operation soon. The producers of auriferous pyrite of Gilpin and Clear Creek counties again expect great benefits, and the outcome will be watched with much interest. The new corporation has taken control of the mines owned by the Banner Consolidated and its subsidiary companies in Clear Creek county, and of the Kilton Sampling Works at Idaho Springs.

The mining operations of the various camps in this State for the past week, in addition to the work of the regular producers, is largely confined to extensive preparations for the summer's work, and this has been long delayed by the abnormally late snow fall, which, at the high mines, has been continuing up to this time. The only news of special interest is that new strikes of rich gold ore have been reported in the Portland mine of the Cripple Creek district, and in the Camp Bird in the San Juan region. The Iowa-Tiger Leasing Company, of the Silverton district, has declared a dividend of 40 per cent., 20 per cent. payable May 15, and 20 per cent. June 15.

The deep drainage tunnel of Cripple Creek has now been driven 9000 ft., or about two-thirds the distance to that part of the district where it is expected to tap the underground waters.

In Routt county, in the vicinity of Lay, on the projected line of the Denver, Northwestern & Pacific Railway, are some extensive gold placer deposits, which were first discovered in 1887 at the same time as the Four-Mile placers, near the Wyoming line. Four years ago a dredge was installed in Lay Creek valley, and about ten acres worked over, but it was not a success, largely owing to the scarcity of water. The beds are light-colored quartz sand. The gold is in nugget form, rather than flakes, and very pure, ranging from 0.885 to 0.935 in fineness. Its origin is undetermined, but the deposits lie in what appears to be a lake basin of Tertiary age. The Iron Springs Placer Mining Company, has just filed its articles of incorporation with the Secretary of State, with offices at Denver, Mason City and Chicago, and will begin systematic work this summer. The manager is A. G. Wallihan, of Lay, who has lived there for twenty years as locator and part owner in the coal beds which also underlie this territory, and which are owned by the Wisconsin Fuel and Mining Company, of Milwaukee.

The Modern Smelting and Refining Company has erected a copper smelting plant at Utah Junction near Denver and expects to be able to receive ores soon. The ores most desired are those of gold, silver and copper. Such ores containing a good percentage of iron and sulphur can be obtained from Gilpin county, and the company has already made a number of contracts with shipping mines. H. C. Reno, 610 Ideal building, Denver, is president of the company.

Indianapolis

May 31—Abraham Parks and five other coal miners have brought suit against Thos. L. Lewis, national president and other officials of the Mine Workers' Association to recover $2000 each, as alleged damages for having expelled them from the association, depriving them of their union cards and of opportunity to secure employment. The suits are the outgrowth of the plaintiffs having been fined $1 per day by the Vandalia Coal Company for refusing to enter the Rosebud mine after an explosion took place therein. The plaintiffs recovered by suit from the Vandalia Company the money so retained as fines, and the national officers made the amount good to the coal company because of the agreement that such a fine should be collected in case of a walkout pending differences. This led to the expulsion of the plaintiffs who now seek damages from President Lewis and others. If they win 22 other miners will likewise bring suit.

Charged with being the instigators and leaders in the riotous movement that caused the expulsion of 50 foreign coal miners from Hymera, nine American miners have been placed under arrest and are now under bond at Sullivan.

In consequence of this matter a movement has been started to appoint a deputy sheriff in each mining camp in the State to report any trouble among the miners and to make arrests when conditions warrant, in order to keep the peace and prevent racial troubles.

Salt Lake City

May 27—G. A. Overstrom, professor of mining and mill design at the Uni-

versity of Utah and the inventor of the Overstrom concentrating tables, has invented a new classifier. The proposed device depends on the different velocities of water to separate the different sizes of ore. The classifier consists of a number of parallel upright pipes fed at the bottom by a common pipe. The water flows into these pipes with greater velocity in the ones of smaller diameter and in this way the slimes are taken off in the first pipes which are of relatively large diameter and the concentrates in the last ones, which are of smaller bore.

The report of the Daly West Mining Company, for the last quarter shows receipts from ore sales of $132,558, with disbursements amounting to $130,652. It was necessary to draw on the reserve fund, which on March 31 amounted to $314,630, to meet the regular dividend, the blocking of the road to the mine and the failure of the water supply lessening the receipts. The report says that the production cost will be cut down materially by the driving of a crosscut to the vein on the 1700-ft. level.

The output of the Tintic mines during the week was 209 cars. The shipments in 50-ton cars were: Ajax, 1; Bullion Beck (leasers), 2; Centennial Eureka, 42; Eureka Hill (leasers), 1; Grand Central, 5; Iron Blossom, 3; Grand Central, 5; May Day (crude ores), 2; May Day (concentrates), 2; Mammoth, 14; Sioux Consolidated, 14; Victoria Consolidated, 1; Victoria, 4; in 20-ton cars; Beck Tunnel, 5; Brooklyn, 6; Colorado, 26; Dragon Iron, 33; Iron Blossom, 44; Swansea Consolidated, 2.

As a result of several conferences with Gifford Pinchot, chief of the forest service, the committee of the American Mining Congress on mining in the national forests has received an encouraging communication from Chief Pinchot, outlining the friendly attitude of the forest service toward legitimate users of timber and giving a resumé of the instructions recently sent to the members of the forest service on this subject. Mr. Pinchot said in part: "I hope that these new instructions will remove any possible doubt as to the friendly interest of the forest service in the mining industry. The service desires that men engaged in prospecting or developing mining claims in the national forests should have a liberal free use of timber from the forests, if the timber on any claim is not sufficient for its development, so long as it is a prospect and not a producing mine. When a prospect becomes a mine and begins to produce ore, it is then a commercial enterprise and no more entitled to free use of government timber than any other business. This policy will be followed in the administration of the national forests, and a conveniently accessible and permanent supply of timber for mining will be provided whenever practicable."

Toronto

May 27—The Canadian Pacific railway is commencing boring operations for natural gas at Bassano, Alta, 83 miles east of Calgary. Eugene Coste, of Toronto, has been engaged for some time in making an examination of the field, and has reported that he is convinced that gas occurs in large quantities. He is of opinion that a series of gas pockets follow the same strata as that from which the Old Glory well on Bow island, Medicine Hat, gets its supply. The company will also undertake drilling for oil at Bow island. If gas in paying quantities is struck at Bassano it will be piped to Calgary.

D. D. Cairns and party, from the Geological Survey, have left to conduct investigations in the copper-, silver- and gold-fields of the Watson and Wheaton districts in the southwestern section of Yukon territory.

The Ontario Government has appointed H. W. Richardson, R. V. Rogers and T. W. Nash, of Kingston, and Prof. Willet G. Miller, of Toronto, as its representatives on the board of governors of the Kingston School of Mining.

Johannesburg

May 5—Eight years ago the two boreholes put down by the Turf Mines, Ltd., (recently amalgamated with the Village Deep) cut the Main Reef series and provided important testimony as to the persistence of the Rand gold carriers to a depth of over 4000 ft. For various reasons the sinking of a shaft to exploit the property was delayed, but the first sod was cut and sinking commenced in June, 1906. It was then estimated that the series would be reached at a depth of 3700 ft. In April, of this year, the forecast was confirmed with creditable accuracy by the intersection of South Reef at 3756 feet.

Unfortunately the reef disclosed is narrow and of poor grade. There are good reasons, however, for not allowing this fact to cause anxiety as to the future prosperity of Central Rand deep levels, quite apart from the danger of considering a single shaft exposure as a reliable sample for the valuation of a large area. The experience of the Village Deep workings alone, and of development in the neighboring City Deep, has gone to indicate a distinct falling off in the average grade of the South Reef, but an equally marked compensation in the higher gold contents of the underlying Main Reef leader. This reef should be cut in the Turf shaft two weeks after passing the South Reef. The announcement of poor assays from the South Reef at this depth would doubtless have had a depressing influence upon Rand mining, had it not been proved by thousands of feet of development in the City Deep that the theory of gradual impoverishment with depth is without justification. In a less eminent degree the Village Deep itself has proved that while changes of grade may be expected upon the extension of operations on the Dip, an improvement may be looked for as reasonably as a reduction in gold contents.

Commenced, as stated above, in June, 1906, the Turf Mines shaft (or the Turf shaft of the Village Deep, as it should now be termed) has been sunk at an average speed of 114 ft. per month and, at a total cost of $170 per ft., including all equipment. The speed does not come up to that maintained in the recently sunk Brakpan shaft in the East Rand, owing to the much more difficult formation passed through and to the use of skips instead of buckets. The Turf shaft has passed through numerous dikes, some of which, almost vertical, cut diagonally through the excavation and necessitated a special ingenuity on the part of the management to arrange bearers providing for permanent security. With the dikes, too, a great influx of water always occurs. Although no one could attempt to minimize the excellence of the work performed in sinking the Brakpan vertical shaft, its freedom from such troubles must be noted in comparative references. The employment of buckets in that case also made for great rapidity of sinking. In the Turf shaft skips were used after the initial stage with a view to greater safety. With skips, the timber sets are carried about 15 ft. from the bottom of the excavation, instead of 50 or 60 ft. with buckets.

The Turf shaft is of seven compartments—the standard for present deep levels—and measures 48x8 ft. in the clear. Its long axis is at right angles to the strike of the formation—a provision for greater strength which doubtless proved of great importance when the several stretches of troubled ground were being negotiated.

Hand labor, the cheapest and quickest means of sinking under Rand conditions, was employed throughout. There were three 8-hr. shifts, and on the average, 40 holes, 30 to 40 in. deep, were put in and blasted per shift. About 80 natives were employed each shift on shoveling and drilling. The work has throughout been under the control of Mr. Saner, manager, and Mr. Coombe, mine captain, who are now engaged in also sinking the South Rand shaft of the Crown Mines, Ltd. It has often been pointed out that these great vertical shafts will play a less important part in Rand mining than was at one time contemplated, owing to the more favored policy of amalgamation and the consequently facilitated extension of the inclines from existing verticals for the service of the deeper ground. At the same time there will still be need for new verticals in the Central Rand and the basin of the Far Eastern Rand will require many new shafts, of a depth of 3000 to 4000 ft. for its economic exploitation.

Mining News from All Parts of the World

New Enterprises, Installations of New Machinery, Development of Mines and Transfers of Property Reported by Special Correspondents

THE CURRENT HISTORY OF MINING

Alaska

VALDEZ

Dr. E. T. Griffith, of Chicago, who has been developing important copper deposits near Landlock, has purchased machinery in Seattle, including power drills and hydroelectric plant with which to rush further operations. It is claimed that the orebody is 100 ft. in width and of a good grade.

F. H. Moffit, of the United States Geological Survey, will arrive here in a few days with a party of four men for work in the Copper river valley, while R. H. Sargent, topographer, will lead a party of seven men into the Matanuski country at the head of Cook's Inlet to make maps of the coal country.

Alaska Commercial Oil Company—This company, with offices in Seattle, has acquired ten oil claims near Katalla, and it is the intention to ship the product to the Orient. W. B. Kavanaugh is president.

Arizona

COCHISE COUNTY

Shattuck-Arizona—The mine is shipping ore from the development work on the 600-ft. level.

Copper Queen—Two additional furneces were blown in at Douglas, making nine furnaces now in operation. The air compressor for the central power plant at the Casey shaft, Courtland, has arrived and is now being installed.

Great Western—Work has been started on a three-compartment shaft on the Mamie claim, at the upper end of the patented ground of the Courtland Townsite Improvement Company. A gasolene hoist will be installed for preliminary work. The new shaft is near the Humboldt shaft, which is one of the oldest shafts in the Turquoise district.

Shamrock—This is the name of a new town in the Chiricahua mountains, organized by the Bisbee-Sonora Development Company.

Bisbee-Sonora—The property is opened by two 340-ft. tunnels, which cut the orebody at a depth of 150 and 235 ft. respectively. Work has begun on a 600-ft. tunnel which will strike the orebody at a depth of 275 feet.

GILA COUNTY

Inspiration—Reports from the mine are encouraging. The main shaft is 800 ft. from the Miami, and is 180 ft. deep, 80 ft. of which are in a low-grade copper sulphide.

Arizona-Commercial—The concrete foundations for the new machinery will be completed within a week. The new double-drum hoist has a capacity for sinking to a depth of 1500 feet.

Cordova—Work has been begun on a new three-compartment shaft on the Eureka property.

MARICOPA COUNTY

Esperanza—R. D. Le Grand and other capitalists of Pasadena, Cal., have purchased this group of mining claims, situated three miles east of the Harqua Hala mine. Development work will begin at once.

PIMA COUNTY

Twin Buttes—About 60 tons of ore per day are being taken out in development work and shipped over the company's railroad to Tucson, and thence to the smelter at El Paso.

PINAL COUNTY

El Tiro—The installation of a 250-h.p. hoist, three boilers, a compressor plant and steel headframe for the three-compartment working shaft has been completed. A 300-kw. generator is being put in, and a mill will be built soon. H. C. Smith is general manager.

Helvetia—Ninety men are employed on development work. Preparations are being made to connect the Copper World and Leader shafts with a crosscut 400 ft. long. Sixty tons of ore per day are being hauled with teams to Vail, and thence shipped to the Old Dominion smelter at Globe.

SANTA CRUZ COUNTY

Leek-Mcdonald—The mine was recently sold to William Kemp and associates, who are now putting it in shape for ore production. J. M. Thomas, of Globe, Arizona, is superintendent. The property is 12 miles from Patagonia.

Castle Butte—The mine is four miles from Patagonia, and will be prospected by a churn drill, which is now being put in place. The mine was recently bonded by California people, who have made partial payment.

Four Metals—The raise to connect the upper and lower tunnels at the Red Hill mine is completed. This connects the tunnels from the opposite sides of the mountain, making good ventilation in the mine.

California

AMADOR COUNTY

Amador Mines Company—J. J. McSorley, of Mokelumne Hill, Calaveras county, has sold to the Amador Mines Company, of Amador City, the Original Amador mine for $35,000. The mine adjoins the Keystone on the north.

BUTTE COUNTY

Carlisle—A vein which has been hunted for years has been found in this mine at Forbestown. A mill and compressor are being fitted up and a pipe-line constructed. The mine is under bond to Eugene Schmidt, former Mayor of San Francisco.

J. H. Leggett Dredging Company—At Oroville a pit is being excavated for a new dredge on 300 acres of land north of Palermo. When the new dredge is finished, the machinery of Dredge No. 3, which has worked out its ground, will be placed in it. J. H. Leggett, of Oroville, is manager.

CALAVERAS COUNTY

Boston Flat—Alcaraz & Sorensen, while working their gravel claim near San Andreas, struck a quartz claim which assays well.

North Star—The main shaft of this mine near San Andreas has been cleaned out and repaired for the inspection of men desirous of taking hold of the property.

Reiner—The new power line has been completed and steam will no longer be used.

INYO COUNTY

Four Metals Smelting and Mining Company—This company at Keeler is now running its 50-ton smelter regularly and has the properties of the Great Western Ore Purchasing Company under lease. The aërial tramway connecting mine and smelter is 5½ miles long. The upper terminal of the tramway is at the old Cerro Gordo mine. The office of this company is at San Jose, Santa Clara county; Henry T. Welch is president and A. R. Short secretary.

MADERA COUNTY

Europa—R. L. Hargrave, near Raymond, has let a contract for a 300-ft. drift which will be connected by an upraise with the upper level. All the machinery including the mill, is run by gasolene engines.

MODOC COUNTY

Cinnabar ore has been discovered in

Willow Ranch district, near Goose lake, and a number of claims have been staked, though not much development has yet been made. Fort Bidwell people are the owners.

MONO COUNTY

Quartz—The discovery of rich gold quartz 12 miles from Bodie by Edward Gray and Albert Belmont has drawn a number of prospectors from Bodie in that direction.

Snow Drift—O'Hanley, McCarty & Burnett, leasers, are taking out $26 ore from the old workings.

NEVADA COUNTY

Empire Mines Company—At this property, Grass Valley, Geo. E. Starr manager, the first of the twin five-plunger pumps has been tested with satisfactory results. Each has a contract agreement to lift 500 gal. a minute a vertical lift of 600 ft. The pumps are to be put on the 2000- and 3400-levels as sinking to a greater depth is intended.

Ocean Star—This mine at Ormonde, four miles from Washington, has been bonded to E. C. Reed and F. U. Hubbell, of San Francisco. The latter will be resident superintendent.

Pittsburg—The new eight-drill compressor has been started at the Grass Valley mine; Mark B. Kerr is manager.

Republic—The new 10-stamp mill of this mine in Graniteville district has been started up. It is expected that the National will be consolidated with this property.

PLACER COUNTY

Big Giant—Dependener & Tyler are running an adit into this mine on a 13-ft. vein. Several rich pockets have been found.

Herman Property Syndicate—This is a new company which has taken hold of the old Herman mine at Westville. E. B. Quigley has charge. The mine has an old 10-stamp mill and a new one of 30 stamps partly finished.

Placer Queen—Cavanaugh and Cullen have struck good gravel at Robinson Flat. The tunnel is in 2500 ft. The channel is at a great altitude in the mountains.

PLUMAS COUNTY

Crown Point—Geo. McCall, one of the leasers on this property, has found a small but rich vein and ore is now being taken out.

California & Nevada Consolidated—In addition to the strike made in this mine in March, another has been made in which the orebody is large and rich.

SAN BERNARDINO COUNTY

Twenty Nine Palms Consolidated—In a shallow shaft at Twenty Nine Palms crosscut opened a 3-ft. vein of ore which runs up to $20 per ton.

SIERRA COUNTY

Brush Creek & Ante-Up—This Chicago company, which has a bond on the old Brush Creek mine, near Mountain House, is about to reopen it. When the men were driven out by water years ago there was a wide vein in the bottom of the 700-ft. shaft carrying good values. L. A. Armstrong is engineer in charge.

SISKIYOU COUNTY

Advance—This mine is about to start up again. Howard V. Lewis is superintendent.

Eastlick—The Eastlick mines and ditches at Oro Fino have been purchased at forced sale by the Reichman Company, of Fort Jones.

TRINITY COUNTY

Dorleska—At this mine, Coffee Creek, some very good ore has recently been uncovered. The mine is still isolated by the snow.

TUOLUMNE COUNTY

Esmeralda—This mine near Carters, on the East Belt, is now showing up a larger vein than was at first found, and the grade of ore is satisfactory.

Colorado

CLEAR CREEK COUNTY

Honest John—A larger air compressor is to be installed, and the company is considering the installation of an aërial tramway 7000 ft. in length, to transport the ores from the mine to the mill. J. F. Puchert, Georgetown, Colo., is manager.

Waldorf Consolidated—Another unit of 125 tons is to be added to the company's mill in the Argentine district. E. J. Wilcox, 314 Colorado building, Denver, Colo., is manager.

Gold Treasure—Denver people are interested in this property and intend to install machinery. Ira Pollard, Idaho Springs, Colo., is manager. They have recently opened up some smelting ore.

GILPIN COUNTY

Great Bonanza, Limited—This company has an option on the German Consolidated group of claims contiguous to its property. If the option is taken up larger machinery will be needed. Cecil C. Morgan, Central City, Colo., is manager.

Federal and Lillian—Eastern people have taken hold of these properties in the Russell district, under a lease and bond, with G. Knutzen, Russell Gulch, Colo., as manager.

Gandon Mining and Investment Company—Clinton Reed and associates, of Denver, have organized this company to operate the Leavenworth mine in the Russell district. An air-compressor plant may be installed. W. C. Le Prowse is in charge.

Gomer—A four-ton shipment of exceptionally high-grade ore was recently sent to the sampling works. A. A. Johnson, Russell Gulch, Colo., is manager.

Egyptian—A pool of Austrian leasers has taken hold of this Quartz Hill mine, owned by McFarlane & Sons, of Central City. Good milling ore is being obtained.

Grand Central—Rhode Island people are interested in the resumption operations at the mine on Gunnell hill. Dan MacMasters, Central City, Colo., is manager.

LAKE COUNTY—LEADVILLE

Tribune—Several months ago a lateral was started in the Yak tunnel about 100 ft. west of Ibex No. 4 shaft, to develop this vein; the lateral is now in 500 ft. and a fair body of gold-bearing ore has been encountered. The vein is from 5 to 7 ft. wide, and the trend is northeast and southwest. It is near the Little Vinnie and Little Jonny. Before this vein was encountered a body of sulphide ore was opened about 250 ft. from the tunnel, but was considered too low to ship. It is now the intention of the lessees to sink a winze on this orebody and develop it. Willis S. Brown, of Belvidere, Ill., is president of the leasing company.

South Evans Gulch—With the opening of spring a number of properties in this section have resumed work, among them being the Ella, which is shipping several cars, weekly, of oxide ore from the 150-ft. level. On other properties development work is in progress as follows: Martha, prospecting is being carried on at the 150-ft. level; Wall Street, sinking from the 100-ft. level; Crucifixion, shipping oxide from the 150-ft. level; Silent Friend, driving from Yak tunnel to connect with workings 300 ft.; Cleveland, shipping 120 tons daily; Tenderfoot and Valley, shipping, respectively, 30 and 40 tons daily; Favorite, development work is being done and the shaft will be probably sunk another 150 feet.

Garbutt—This property is shipping daily 35 tons of lead sulphide ore. The orebody is 25 ft. high and 35 ft. wide, and has been developed for several hundred feet. It is under lease to John Cortillini and associates.

Fortune—Several days ago connections were made with this mine and the Yak tunnel, and 25 tons of ore are now going out daily through the big bore; the ore is of excellent grade.

Last Chance—B. DuBois will resume work on this mine in a short time. At present surface work is being done preparatory to sinking.

Gnu—This shaft belonging to the Nisi Prius company and under lease to John Harvey *et al.*, is producing 25 tons of good lead ore daily.

Pyrenees—The large pumps recently installed have started to raise the water from the lower levels; it will take about six weeks to unwater the ground.

OURAY COUNTY

Camp Bird—Report for April: Mill ran 29 days; crushed 6684 tons of ore; produced 613 tons of concentrates and 13,357 oz. bullion; total sales, $282,434; expenses, $54,243; balance applicable to profit, $228,191; development work, 672 feet.

Idaho

SHOSHONE COUNTY

The shipment of the first consignment of ore, to go all the way to the smelter by rail, was made from the Murray district recently. The shipment was made from the Black Horse mine.

Iowa

WAPELLO COUNTY

Ottumwa Iron Works—A report has been circulated through the Associated Press that this plant was totally destroyed by fire. This report probably originated from the burning of the foundry roof. The damage has not only been repaired, but the foundry has been enlarged and improved machinery added to increase the output of mining machinery.

Michigan

COPPER

Ahmeek—Arrangements have been made with the Franklin company to handle approximately 750 tons of Ahmeek rock daily. Shipments of about the same amount will be continued to the Tamarack mill. A contract has been let for the construction of the railroad spur connecting the mill with the lines of the Mineral Range railroad.

Mass—This company has reached the new lode by means of one of the crosscuts it is driving from the 15th level, but has not yet entered it far enough to determine its width or copper contents. The other three crosscuts are nearing the formation and when the lode is opened by these four points, in addition to the drift from the 17th level, which is now about 130 ft. in length, its commercial value should be practically determined.

Victoria—A continuous stretch of good ground has been opened up at the 22d level. A crosscut is being driven from the 12 level to ascertain the condition at that point. The hydraulic plant is working satisfactorily with an ample water supply.

Mohawk—Ground is to be broken by this company on the site of its new, or No. 6 shaft within a few days. This will go down in the foot wall, about 60 ft. behind the lode which it will open by means of crosscut from the various levels. Shipments aggregating about 2700 tons daily are being made to the mill from the other shafts.

Adventure—This company contemplates opening up the newly discovered Mass lode on its property by means of crosscuts. The crosscut from No. 1 shaft will reveal the lode close to surface and at No. 3 about 800 ft. deep. This vein has also been traced on surface by means of trenches and holds forth great promise.

La Salle—Work has been discontinued at No. 2 shaft on the Caldwell tract, after carrying on considerable exploratory work without striking any encouraging results. It is now planned to sink a new shaft between the shaft on the Tecumseh tract and No. 1 shaft of the Caldwell. No. 1 shaft of the Tecumseh is opening some very encouraging ground.

Hancock—The winze from the 13th to the 18th level, at which point it will intersect the main working crosscut from the 15th level of No. 2 shaft, is down to the 15th level. This winze is sinking on what is known as No. 3 lode and has disclosed good mineralization throughout its depth. Good ground is also being blocked out in the extensions of the drifts from the 13th and 14th levels. No. 2 shaft is sinking close to the 18th level and should cut the orebody at the 20th level, which, at the present rate of sinking, will be in August. No. 2 shaft is to have railroad facilities in the near future.

Wolverine—A fire destroyed the roof of this company's main boiler-house, but little damage was done to the boilers or compressors which were in this building. Operations were delayed only a few hours.

Missouri

JOPLIN—ZINC-LEAD DISTRICT

Goode Brothers—Plans are being made for the erection of a large mill on their lease of the Little Boss Mining Company.

Sycamore—Jones & Garvan, of Granby, have bought a mill which they will erect on the land of the Little Boss Mining Company, at Granby.

Sunrise—C. V. Millar, manager, is rebuilding the mill at Spring City, which was recently destroyed by fire.

Microbe—Adam Scott, manager, Joplin, will erect a mill on this lease at Spring City.

Delta—This mine, at Spring City, has been reopened under new management. A new shaft will be sunk.

United Zinc—The company has taken the McKinley lease on the Connor ground at Prosperity and will thoroughly drill and develop it. George T. Fletcher, of Joplin, is manager.

Silver Plume—The mill is being rebuilt and will start operations at once. Warren Heaton, of Joplin, is manager.

Herald Zinc and Lead—New and larger machinery is being installed at the mine near Cave Springs.

Cameron—The building of the new Cameron mill at Sarcoxie has added another producer to that already enterprising camp. The mill has a capacity of 400 tons per day and is now turning out a fair tonnage.

Coahuilla—Four men were killed recently in this mine by a slab of rock falling from the roof.

Montana

BUTTE DISTRICT

Amalgamated—It is reported that at the Gagnon mine plans are being made for the sinking of a new shaft. In that event the incline shaft, 2300 ft. deep, now in use will be abondoned. For the past several years the mine has made a poor showing but recently developments indicate that the property has greatly increased in value at its present depth and that the expenditure of money necessary for the new shaft will be justified.

Butte & Superior—A strike of copper ore is reported on the 1200-ft. level at a point about 400 ft. west of the shaft. It is stated that the ore runs 2 per cent. copper and 30 per cent. zinc.

Copper Eagle—Work is progressing on the 350-ft. level. On this level drifting has been done 300 ft. east of the shaft and 50 ft. west. The shaft is 365 ft. in depth.

BROADWATER COUNTY

Ohio-Keating Company—Machinery has been ordered and work of unwatering the shaft will be begun shortly.

FLATHEAD COUNTY

Northern Idaho & Montana Power Company—The company has recently purchased the plant of the Kalispell Water and Electric Company. The new company plans an expenditure of $200,000 on improvements on the plant and system of the old company.

JEFFERSON COUNTY

Jefferson Lime Company—The company has recently sold its plant and ground to the Pittsmont Copper Company, of Butte. This is part of the plan of the East Butte company to carry on active operations at the Pittsmont company's smelter. The ground purchased is located on the Northern Pacific Railway at Lime Spur, and the limestone will be conveyed by that road direct to the smelter of the Pittsmont company.

LEWIS & CLARK COUNTY

East Helena Smelter—A demand has recently been made by the employees for an increase in wages of 50c. per day. While no definite statement has been given out, it is expected that the demand will be refused.

Nevada

ESMERALDA COUNTY—GOLDFIELD

Kansas City Velvet—Another shipment is being prepared on this lease and will be sent out in a few days. The ore is

being taken from a vein 18 in. wide which runs $60 per ton.

Goldfield Daisy—This property is now working two shifts employing between 50 and 60 men. A daily production of 10 tons is being maintained, five tons of which, coming from the 200-ft. level, runs about $100 per ton. The balance is dump ore and assays from $20 to $25 per ton. Development work is being carried on in both the 300- and 500-ft. levels.

Goldfield Florence—Another tube mill is to be installed at the mill as soon as the order can be filled. This will increase the capacity of the mill about 25 per cent. At present the mill is treating from 140 to 150 tons per day. Much underground development is in progress.

Stoneham Moore—This lease, operating on the Combination No. 2 lode of the Consolidated property, will sink to the 1000 ft. level. Particular attention will be given to prospecting on the 500-ft. level where a streak of high-grade ore was recently encountered.

Grizzly Bear—A new 75-h.p. electric hoist and large gallows frame have been installed. The shaft, now 500 ft. deep, will be sunk to the 1000-ft. level. On reaching the footwall of the Clermont vein, now showing in the shaft, a station will be cut and the vein prospected.

ESMERALDA COUNTY—HORNSILVER

Great Western Mine—This property has been closed down for an indefinite period. Howard Russell, secretary and one of the principal owners of the company, is credited with stating that the mine will remain closed until better transportation facilities are afforded or a mill is constructed in the camp. The Tonopah & Tidewater Railroad is sending a corps of engineers in the field to make a preliminary survey between Hornsilver and Cuprite, the shipping point on the railroad, 16 miles distant.

LANDER COUNTY—AUSTIN

Highland Mary—George Kilborn, of Reno, has taken an option on this property which is one of the oldest in the district.

LINCOLN COUNTY—PIOCHE

Nevada Utah Mining and Smelting Corporation—This company is now shipping about 125 tons daily to the Salt Lake smelters, from its Day mine 15 miles northwest of Pioche. Superintendent Gaskill estimates that 175,000 tons have been opened up by recent development.

Ohio Kentucky—This company is negotiating with the Nevada-Utah company for the purpose of reaching some agreement regarding disputed territory held jointly in Pioche. The property has been idle for nearly two years because the companies could not come to an agreement.

Prince Consolidated—This property, situated about two miles southwest of Pioche, shipped three carloads last week to the Tintic smelter. Ernest L. Godbe, of Salt Lake City, is manager, and Wm. Lloyd, of Pioche, superintendent. The shaft is now 550 ft. deep. At this level there is 3 ft. of ore running high in silver and lead.

Pioche King—Several feet of manganese ore, also carbonates and sulphide of lead, were encountered at about 180 ft. depth, the latter carrying precious metal. John A. Kirby, of Salt Lake City, is president and manager.

Golden Prince—George Coxe, manager, has encountered manganese ore in the shaft at 430 ft., and in the west drift at 400-ft. level, 140 ft. from the shaft, ore showing good assay returns has been found.

Gold and Silver Prince—Dean R. Low, Pioche, manager, has just installed a new 25-h.p. Alamo hoist and compressor. The shaft is now about 90 ft. deep.

Pioche Demijohn—This property, of which Owen Bailey, Salt Lake City, is manager, adjoins the Gold and Silver Prince on the northwest. Some high-grade ore was recently found on the 125-ft. level, but it is understood to have been only in small quantity.

Pioche Metals—The property of this company, about two miles northwest of the Demijohn, is working several men and hoisting some good ore. John A. Kirby and associates control the property.

New Hampshire

COOS COUNTY

Milan Mining and Milling Company—A model B Cadillac has been transformed from the road wheels to 18-in. flange wheels for a narrow-gage railroad, and is now hauling 100 tons of ore in 10 hours from the new mill to the ore bins at the railroad siding, a distance of ⅛ of a mile. The average grade is 3½ per cent., and the cost is 4c. per ton. The new 250-ton ore-dressing, crushing and concentrating plant is now successfully adjusted and operating satisfactorily.

Oklahoma

OTTAWA COUNTY

Old Chief—This company, at Miami, will rebuild the mill recently destroyed by fire.

Moosehead—The company will build a mill on the lease at Miami.

Miami-Yankee—L. C. Church, manager, has struck rich ore at a depth of over 200 ft. on the Emma Gordon ground, at Miami.

King Jack—Chapman & Lennan, of Webb City, are rebuilding the mill at Miami, which was recently destroyed by the explosion of the boiler.

Oregon

BAKER COUNTY

Morning Mine—The mill is treating 30 tons of ore per day averaging from $30 to $40 per ton. The Psyche 20-stamp mill has been purchased and will be moved to the Morning mine as soon as the roads are in condition.

South Pole—It is reported that a rich body of gold ore has been found in the main tunnel run from the Rock Spring side of the mountain. Andrew Hansen is the owner, and a five-stamp mill will be started up this month.

Utah

BEAVER COUNTY

King David—At the 300-ft. level of the shaft a big bore is being driven in a body of iron sulphides. The sinking of the shaft will be continued as the bottom indications are excellent.

Lydia—H. T. Hanks, who has been operating this property in the Star district has uncovered a large orebody. On the 50-ft. level he has drifted 60 ft. and on the 100-ft. level has drifted 35 ft., all in ore. A gasolene engine and other machinery is being installed to hasten the work.

SALT LAKE COUNTY

Columbus Consolidated—The new pump is being taken to the mine at Alta and will be in commission early in June. The new pump weighs 30,000 lb., has a capacity of 800 gal. per min. and is run by a 150-h.p. motor.

SUMMIT COUNTY

Silver King Consolidated — Manager Solon Spiro, 426 Atlas block, Salt Lake City, visited the mine recently and reports that a winze being sunk from the south drift on the 1100-ft. level is now in good ore. The wagon road to the mine has been cleared of snow and the mine will be able to ship at once.

TOOELE COUNTY

Old Glory—The wagon road to Wendover on the new Western Pacific has been completed and the shipment of the high-grade ore will start at once. With these transportation facilities available, the company will now install a compressor plant and machine drills and increase the force at the mine. D. L. Fulop, 216 Dooly block, Salt Lake City, is president of the company.

Washington

KING COUNTY—BERLIN

Miller River and Money Creek districts are coming to the front through the operations of the Apex, Seattle Cascade, Excelsior, Surwalk and the Cleopatra properties.

Seattle Cascade—This company is installing a 115-h.p. power plant, with an air compressor to correspond, and within 60 days will be equipped to carry on development work.

SNOHOMISH COUNTY—EVERETT

Nonpareil—In the Index district this company is surveying 35 claims for patent under United States Deputy Mineral Surveyor Hans Mumm, who resigned the position of city engineer of Everett to take up this work.

Northwestern Consolidated—An order for 6000 ft. of steel wire cable for an aërial tram near Monte Cristo, and a complete telephone system to connect with the terminus of the railroad has been placed by this company. J. C. Morton is manager of the company.

Canada

BRITISH COLUMBIA—QUEEN CHARLOTTE ISLANDS

Awaya, Ikeda & Co.—Another big ore-body has been encountered in the lowest tunnel (No. 3) of the Japanese company's mine at Ikeda bay, Moresby island. The tunnel is 40 ft. in ore and the footwall not yet reached. The ore averages about 5 per cent. copper and $3 per ton in gold. Shipments are being made to the Tyee Copper Company's smelter at Ladysmith, Vancouver island.

ONTARIO—COBALT DISTRICT

Ore Shipments—Shipments of ore from Cobalt for the week ended May 22 were: Coniagas, 64,300 lb.; Crown Reserve, 126,400; Kerr Lake, 203,760; King Edward, 43,130; La Rose, 291,400; McKinley-Darragh, 50,670; Nipissing,, 453,850; Peterson Lake, 67,580; Right-of-way, 249,130; Temiskaming & Hudson Bay, 60,000; total 1,610,220 pounds.

YUKON TERRITORY—DAWSON

In a previous issue reference was made to the early breaking up of the ice in front of Dawson, permitting local navigation. Fifty-Mile river, a branch of the Yukon, is now open from White Horse to the head of Lake Lebarge, but the lake itself is still frozen. At Hootalinqua the river is also breaking up. It is expected that navigation will open June 9 for the whole length of the river.

The copper deposits of the Yukon adjacent to the Bonanza properties of the Guggenheims have gained official recognition through an examination by a government mining engineer, A. J. Beaudette, whose visit was by instruction of Governor Henderson.

Last year the largest navigation company operating on the Yukon received $73 per ton for cargo from Seattle to Fairbanks, while this year the rate is $65, while another company is quoting rates of $50. The opinion prevails that while the temporary cut in rates due to competition will be of immense benefit for this season, the final result will be a little higher, and yet much lower than in previous years.

Bonanza Creek—Claim No. 39 below on Bonanza has been staked by C. W. Cornish, of the Yukon Gold Company. This claim was allowed to lapse in 1908 and recent investigation pursued quietly proved the claim to be of great value.

Bonanza Creek Gold Mining Company, Ltd.—The Guggenheims have acquired the properties of this company, formerly known as the Weinheim company, which operated under the concessions granted to Matson & Doyle.

Dome Lode Development Company—Progress on the Dominion Dome has taken on new life through the appointment of D. J. McDonald as manager; formerly of Le Roi Mine of Rossland. This is considered significant, since Mr. McDonald would hardly consent to take charge of a property that did not possess future promise.

Herbert Creek—Dolan & Pinkiert have confirmed their good judgment in the purchase of the upper thousand feet of discovery on Herbert creek, several shafts disclosing pay dirt of exceptional value.

YUKON TERRITORY—WHITE HORSE

Work has been stoppd on the spur from the White Pass Railway to the copper mines near White Horse with only one-half of the track laid. Resumption of this work will depend upon the intentions of the mineowners. The railway company can finish the extension in six weeks time.

Mexico

CHIHUAHUA

Candelaria—These old mines are now shipping at the rate of 150 to 200 carloads monthly to the El Paso plant of the American Smelting and Refining Company. The working force numbers about 600. The new pumping plant is handling about 3000 gal. of water per minute and keeps the old workings sufficiently dry to permit of ore extraction in the lower levels and for the sinking of deeper shafts. George A. Laird is in charge.

Mary Mining Company—This company, operating in the Archuyvo district in the western part of this State, has the necessary machinery on the ground for a 10-stamp mill. The property is best reached from Alamos, Sonora. E. McLean is the superintendent.

Santa Eulalia Development Company—An English company, represented by L. M. Cockerell, has a purchase option on the Somnambulo and Nueva Chihuahua mines in the Santa Eulalia camp and will begin immediate development.

San Carlos—This company is making surveys for a railroad to its property in the San Carlos section, in the northern part of the State. One line as projected is to be a spur from the Southern Pacific at either Boquillas or Sanderson, Texas; the other is to run to the Orient railroad in eastern Chihuahua. Dr. C. V. F. Caracristi is general manager.

Urique—It is reported that transfer of the Santa Reyes and Trumbo mines near Urique, has been made to John Paul and Dr. Sheldon, representing New York parties.

Watterson Gold—Among the late bullion shipments received at the local bank is one of nine bars of gold-silver from this company, valued at 19,000 pesos.

DURANGO

La Luz—Daniel E. Webster is making a topographic survey of this and the Santa Inez Mining property for the owners W. R. Giesecke and associates of Gomez Palcio.

Cinco de Mayo—The new shaft has been completed to the water level and obtained an abundant supply of water. With this water available, the work of extracting the ore from the upper workings will begin. It is reported that a rich body of copper ore was recently cut at a depth of 320 feet.

Guanacevi Tunnel Company—At Guanacevi, Durango, the company is receiving bids on an electric equipment for the driving of a development-transportation tunnel 12,000 ft. long. A. D. Meloy, of New York is chief promoter of this enterprise.

GUANAJUATO

Santa Natalia—The first shipment of bullion was made from this mine recently.

Africa

WEST AFRICA

Gold production of the Gold Coast and Dahomey is reported by the West African Chamber of Mines at 21,491 oz. in April, being 1795 oz. less than in March. For the four months ended April 30 the total was 102,032 oz. bullion in 1908, and 88,897 oz. in 1909; a decrease of 13,135 oz. The bullion reported this year was equal to $1,746,885, or 84,513 oz. fine gold.

South America

BRITISH GUIANA

Gold exports for the four months ended April 30 were 17,627 oz. bullion in 1908, and 18,385 oz. in 1909; an increase of 758 oz. The bullion reported this year was equal to $317,955, or 15,373 oz. fine gold.

Exports of diamonds for the four months were 537 carats, valued at $3246; an increase of 149 carats over last year.

Guiana Gold Company—The large new gold dredge built by this company on the Conawarook river sank just after it had been completed, and the day before it was expected to begin work. Faulty construction is suspected to be the cause.

Metal, Mineral, Coal and Stock Markets

Current Prices, Market Conditions and Commercial Statistics of the Metals, Minerals and Mining Stocks

QUOTATIONS FROM IMPORTANT CENTERS

Coal Trade Review

New York, June 2—From the West reports come of an improvement in the demand for steam coal which is growing much faster than it has been for some time past. So far this improvement has not been generally accompanied by any advance in prices, mainly for the reason that producers have been rather too anxious to take advantage of any gain, and have shipped coal to the central market points too freely. Consumption is increasing, however, and the complaints of forced sales to avoid demurrage are not very serious.

In the East improvement in the bituminous trade seems to be much slower than in the West, and a good many complaints are still heard of slow purchasing of coal. That there is some improvement, however, is not denied.

The anthracite trade is steady and rather quiet; many collieries are still running on short time and may continue to do so for another month before accumulated stocks are worked off.

Lake Coal Rates—In Charleston, W. Va., May 27, Judge Keller, of the United States Circuit Court, dissolved the temporary injunction issued by him last April restraining the Kanawha & Michigan, the Chesapeake & Ohio and Norfolk & Western railroads from filing with the Interstate Commerce Commission a proposed tariff increasing the rates on local shipments of coal from West Virginia fields to the lake regions on the ground of lack of jurisdiction. In the case of the Columbus Iron and Steel Company against the Kanawha & Michigan ralroad to prevent the filing of the tariff the Court held it had no right to prevent filing before the Interstate Commerce Commission had determined equity of rate. Similar injunctions in the case of the Imperial Colliery Company versus the Chesapeake & Ohio Railroad and the Powhattan Coal & Coke Railway versus the Norfolk & Western were dissolved. This permits the new rates on Lake coal to go into effect.

Coal Traffic Notes

Tonnage originating on Pennsylvania railroad lines east of Pittsburg and Erie, year to May 22 short tons:

	1908.	1909.	Changes.
Anthracite	2,177,732	2,101,826	D. 75,906
Bituminous	12,590,625	13,659,697	I. 1,069,072
Coke	2,688,395	3,878,226	I. 1,189,831
Total	17,456,752	19,639,749	I. 2,182,997

Increase for the week, 91,656 tons. Total increase this year to date, 12.5 per cent.

New York

Anthracite

June 2—There was a little spurt in the market last week brought about by parties who wanted to get in orders on the May discount. It did not amount to very much, however, and trade generally has been quiet but rather steady. On June 1 another 10c. was taken off the discount and prices for prepared sizes are now $4.45 for lump, and $4.70 for egg, stove and chestnut, all f.o.b. New York harbor. For steam sizes current quotations are unchanged at $3.10@3.25 for pea, $2.35@2.50 for buckwheat, $1.70@2 for rice or buckwheat No. 2, and $1.25@1.50 for barley, f.o.b. New York harbor points.

Bituminous

The Seaboard trade grows slowly, although some advance is perceptible. Taking of coal under contracts is the principal improvement noted. The far East is reported to be thinking about sending in orders, but has hardly got to the point of action. The Sound is doing a little better, and all-rail trade better yet. New York harbor is quiet. Some coal continues to change hands at rather low prices; otherwise there is not much movement.

Coastwise trade is fair, but not as active as it might be. Vessels being in good supply, rates are unchanged.

Birmingham

May 31—The coal trade in Alabama shows little improvement. Some price cutting has been going on, but this has not included any great amount of business. A large number of miners are out of employment and those who are working are not getting in steady time. The coke demand continues good. The annual convention of the United Mine Workers of America, Alabama district No. 20, will be held in Birmingham, June 14. The attendance promises to be small as the union has not been doing much since the strike last year.

Chicago

June 1—While the consumption of steam coals is increasing, the shipments to this market of Illinois and Eastern lump are so large that a good deal of price cutting, due to demurrage regulations, again exists. Fine coals, on the contrary, are comparatively scarce and are advancing slowly. Springfield screenings, a favorite summer fuel, bring $1.45 readily and other screenings from Illinois and Indiana mines sell for $1.55@1.75. Run-of-mine remains at $1.65@1.75, and lump finds purchasers, with difficulty, at $1.75@2.25, these being car prices. Domestic bituminous coals are hardly in the market, sales being very light.

Contract making has been brisk and a larger volume of coal has been sold on contracts than a year ago. But prices are very low on most of this business and the open market seems to have a brighter outlook.

Eastern coals are selling well, but smokeless run-of-mine and Hocking are off 10 or 15c. from list prices because of demurrage. The best smokeless and Hocking, however, hold up well to list quotations. Youghiogheny ¾-in. gas brings $3.15, with a steady market; Pittsburg No. 8 is in similar shape at $2.65 for ¾-in. Anthracite finds a light but steady sale, well distributed.

Cleveland

June 1—The local coal trade is improving and sales are better than they have been. Mills and factories are taking more steam coal. Prices are strengthening, though some coal has been sold low, to avoid demurrage. No. 8 district brings about $1.90@$2.05, Cleveland, for lump; $1.80 for run-of-mine and $1.35@$1.40 for slack. Middle District coal sells at $1.80@$1.95 for lump, $1.70 for run-of-mine and $1.30@$1.35 for slack, all Cleveland.

Lake trade is so slow yet that the railroads are putting an embargo on shipments from mines, the yards being full of coal waiting for vessels up the Lakes.

Indianapolis

May 31—A general review of the coal-mining and market situations shows a decided improvement over the previous week. Operators say that progress is slow, but constant, and with the reported revival in iron and steel industries justifies a hopeful outlook. That more optimism is being shown is evidenced by the opening of several mines during the past week that have been closed from one to two years.

The activity among retail dealers in buying their storage supply which set in the last few days has been encouraging.

The decreasing number of empty cars reflects the increasing run of summer orders. Operators, however, do not believe that conditions will justify anything above a conservative advance in prices at present.

Pittsburg

June 1—The coal market continues quiet, with continued price cutting. Nominal prices remain at $1.10 to manufacturers and $1.20 to retail dealers, for mine-run at mines, but these prices are being shaded 5 to 10 cents a ton as formerly. Slack is quotable at 60 to 65 cents.

Connellsville Coke—The chief topic of conversation in the trade is the merger. The promoters insist that it will be put through and will be able to make fair profits, but the trade at large figures by various methods that it cannot possibly be a success, on account of the high prices asked for the properties, these prices being held to be such that nearly a dollar a ton would have to be earned to carry interest and exhaustion charges, pointing to $2.35@2.50 for coke. In view of the many other sources of supply it is maintained that such prices cannot be obtained.

The Thompson Connellsville Coke Company has made a contract to supply the Jones & Laughlin Steel Company with 400,000 tons of coke a year for a period of time, believed to be three years from Sept. 1 next. A flat price is to be paid, which is somewhat unusual in such cases. While the price is not stated authoritatively, it is believed in some quarters to be about $2 at ovens.

The coke market is a trifle firmer for prompt coke, $1.50@1.60 being demanded for prompt furnace, second half-contracts remaining at $1.60@1.80, according to grade. Foundry coke is $1.80@2 for prompt and $1.90@2.25 for contract, depending on grade.

The *Courier* notes a gain of 16,000 tons in production in the Connellsville regions in the week ended May 22 as compared with the preceding week, the output being given at 278,729 tons. Shipments are reported at 3296 cars to the Pittsburg district 5433 cars to points west of Pittsburg and 742 cars to points east of Connellsville; a total of 9471 cars a gain of 300 cars.

Foreign Coal Trade

United States Coal Exports—Exports of coal and coke from the United States, four months ended April 30, long tons:

	1908.	1909.	Changes.
Anthracite	703,018	699,350	D. 3,668
Bituminous	2,350,186	2,072,696	D. 277,490
Total coal	3,053,204	2,772,046	D. 281,158
Coke	258,242	330,370	I. 72,128

Canada took this year 1,991,594 tons, or 71.8 per cent. of the total coal. The coke went chiefly to Mexico and Canada.

United States Coal Imports—Imports of coal and coke into the United States, four months ended April 30, long tons:

	1908.	1909.	Changes.
Anthracite	15,023	3,115	D. 11,908
Bituminous	604,142	388,077	D. 216,065
Total coal	619,165	391,192	D. 227,973
Coke	41,444	64,186	I. 22,742

Canada sent this year 330,926 tons of coal and nearly all the coke; Australia, 44,048 tons of coal. Imports are chiefly on the Pacific coast and on the northern border, into Montana and Washington.

Imports of coal into Spain in January were 172,866 metric tons, an increase of 33,073 tons; of coke, 25,757 tons, an increase of 10,151 tons.

Nova Scotia Coal—Coal shipments from Nova Scotia mines, four months ended April 30, long tons:

	1908.	1909.	Changes.
Dominion	778,291	549,632	D. 228,659
Nova Scotia Steel	155,746	112,141	D. 43,605
Cumberland	144,528	124,355	D. 20,173
Acadia	106,421	75,831	D. 30,590
Inverness	68,691	48,957	D. 19,734
Intercolonial	90,055	80,139	D. 9,916
Total	1,343,732	991,055	D. 352,677

The total decrease this year to date was 26.2 per cent. In the March statement, recently published, the figures for 1908 and 1909 were accidentally reversed.

Welsh Coal Prices—Messrs. Hull, Blyth & Co., London and Cardiff, report current prices of coal as follows, on May 22: Best Welsh steam, $4.02; seconds, $3.84; thirds, $3.60; dry coals, $3.84; best Monmouthshire, $3.48; seconds, $3.36; best small steam, $2.64; seconds, $2.46. All per long ton, f.o.b. shipping port. This is an advance on Welsh coals.

Iron Trade Review

New York, June 2—There are signs of a slight lull in buying following the extreme activity which the iron and steel trades showed in the latter part of May. It does not appear that this will be a serious check, but rather a pause to take stock and see what has been done. The effect of the recent activity has been to fill most of the mills with work for at least three months to come and put buyers in a position to supply the actual and expected demands from consumers. Some slight advances in price have been made, but the great bulk of the business placed has been at the lowest figures.

In pig iron basic sales continue active and a good deal is still being done in foundry iron. Furnaces in blast are increasing in number, especially those owned by the steel companies. A few of the latter have been buying bessemer pig from outside furnaces, which has not been done for over a year and a half. The merchant furnaces are consequently rather firm on prices, not making advances for immediate deliveries, but making no concessions and looking for 25 or 50c. more for third- and fourth-quarter deliveries.

Running parallel with the demand for basic iron has been an increased demand for scrap. This has been felt to some extent in foundry scrap, but in a much greater degree in the call for heavy steel melting scrap which is beginning to be rather scarce.

In finished material, structural steel is still in the lead, but large business has been placed in plates, sheets and bars. The railroads are still holding back on rails, although small orders are coming in more freely, and there is quite a market for light rails. The railroads have been ordering a good number of steel cars and are also asking bids for many locomotives.

Tinplate Capacity—It is announced that the Jones & Laughlin Steel Company, in addition to other improvements, will build a tinplate mill of large capacity, entering into active competition with the American Sheet and Tin Plate Company.

Baltimore

June 1—Exports for the week included 1,396,731 lb. tin-scrap to Rotterdam; 2894 tons rails and 100 tons rail fastenings to Buenos Aires; 3853 tons rails and 299 tons rail fastenings to Mexico. Imports included 4525 tons iron pyrites from Spain; 16,450 tons iron ore from Cuba.

Birmingham

May 31—Southern pig-iron manufacturers are encouraged over the steady inquiry that is being received; some orders are developing. Some selling is still going on and the quotations are strengthening. third-quarter iron being held firmly for $11.50 per ton, No. 2 foundry, and fourth-quarter iron at $12. Reports are still current that one or two companies are inclined toward a lower price, and that $11 is being accepted for June and July deliveries. There is a quantity of iron to be seen in furnace yards, but the statement is that it awaits instructions as to delivery. The foundrymen and machine-shop proprietors in this section of the country have recently been receiving a number of orders and their business is better. Some bidding is going on also on machinery orders. The blowing out of two furnaces this month will be followed by the blowing in of two others in the next few days. It is expected also that within a month the Southern Steel and Iron Company, successor to the Southern Steel Company, will have started preparations looking to a resumption of operations at three blast furnaces, the steel plant at Gadsden and the mills at Ensley. W. H. Hassinger, of Birmingham, was elected president of the reorganized company. Rumors prevail that the Tennessee company will add a structural-steel department to the steel plant at Ensley.

This plant is still idle. The Bessemer rolling mills will resume operations this week after a month's idleness.

Chicago

May 31—Quiet exists in the pig-iron market. The situation has been forecasted in the gradual slackening of the last month or six weeks; it seems due to the fact that foundries in this territory are well provided with iron, up to the last quarter at least, and their proprietors have decided again to go slowly. For needs of the third and fourth quarters the standard purchase remains small—under 500 tons. The selling price of Southern remains nominally $11.50 Birmingham ($15.85 Chicago), but $11.25 and even $11 is done on some business. Northern is quoted at $16.50, but can be had in any good-sized quantity at 25 or 50c. les. With both sellers and buyers watching the market keenly, any decided change stiffening the market will result in comparatively heavy buying, but no such change seems imminent.

In the iron and steel products market conditions continue good, especially in structural material and railroad supplies, and with no notable falling off in any line. Coke is improving as to sales and holds to $4.70 for the best Connellsville.

Cleveland

June 1—Buying of iron ore continues at a fair rate. So far as shipments are concerned, the strike is causing trouble, but not enough to stop boats, or to prevent the movement of ore.

Pig Iron—The sales are steady, but not in large lots. Prices have not been advanced, but are more firmly held, the basis continuing about $15.25, Cleveland, for No. 2 foundry.

Finished Material—Structural steel is in demand still. In other lines the market is quieter, owing chiefly to the recent heavy sales. The mills are busy and buyers are supplied for the present.

Philadelphia

June 2—A stronger tone exists in the pig-iron market. The large buyers of foundry iron have covered their requirements for the most part, but the firming up of prices has brought out many orders from small people, who would not buy before. Prices are a step higher, No. 2X bringing $16.25@16.50, while many sellers ask 25c. more for third-quarter and 50c. for fourth-quarter iron. A large movement in basic still continues. Alabama iron is not much in evidence, but Virginia furnaces are getting some business. Forge iron is looking up.

Steel Billets—Business is chiefly in small lots. Sellers are stiffer in their ideas of price.

Scrap—Prices seem to be advancing, and dealers are not pressing sales, believing that they will do better by holding back. Heavy steel-melting scrap is in demand.

Pittsburg

June 1—The general iron and steel market has become quieter since last report. While there has been no loss in prices there has been a slight loss as to activity. It has become clearer that the buying of finished steel products in the past three months represented a distinct movement, and not the establishment of a rate which would be followed indefinitely. Buyers provided for their known requirements for some distance ahead, while there was a large tonnage bought to be placed in stock, as in many instances the lowest prices were not made unless the buyer would obligate himself to take out a given tonnage by July 1. Thus a heavy pressure is brought upon the mills for the time being. The current rate of production is probably considerably in excess of consumption, this excess going into stocks of jobbers and manufacturers, which were very low.

Pig Iron—The market has been quieter since the advances noted in last report. Buyers seem to be well covered to July 1, while those who have not bought for third quarter seem to be in no hurry to do so. Stocks of unsold iron are large, being estimated by a prominent buyer last week at 1,300,000 tons, of which there are probably 150,000 tons in Alabama and 250,000 tons in Virginia, leaving 900,000 tons for the northern districts. No effort is being made to dispose of these stocks, but should the holders suddenly conclude to liquidate prices would naturally suffer. The market at present is firm. Standard bessemer is firm at a minimum of $15, Valley, for any delivery, some sellers quoting $15.25@15.50. Basic is quoted by a few sellers at $14.50, Valley, for second-half delivery, the majority quoting $14.75, while for prompt iron $14.35 has been done, and this price could possibly be duplicated. Foundry iron is $14.50@14.75, Valley, sales having been made at both prices. Malleable is quoted at $14.50@14.75, Valley, and forge at $13.50@13.75, Valley, the freight to Pittsburg being 90 cents.

Steel—A sale of 1000 tons of sheet-bars for June delivery has been made by a local steel producer to a local tin mill. It is reported that a local steel interest has sold a supply of sheet-bars to a prominent independent tinplate interest for delivery over the second half at a price below the recognized market, which is $25.50, delivered. Billets remain at $23, Pittsburg, with light transactions. Bessemer rods are $29, f.o.b. Pittsburg, and open-hearth $30. Deliveries of plates have improved further. The Pressed Steel Car Company and Standard Steel Car Company are now running at fully half their capacity, and with orders on books will be able to maintain this rate for several months. Plates are firm at 1.30c., Pittsburg, except that this basis is shaded occasionally in the case of large structural contracts.

Sheets—If anything, the market is a trifle weaker, although tonnage is as good as it was. The regular market is 2.20c. on black and 3.20c. on galvanized, on attractive orders, but in special cases these prices are sometimes shaded an extra $1 per ton.

Ferromanganese—The market is quiet. The regular quotation is $41, Baltimore, or $42.95, Pittsburg, but occasionally this price is shaded.

Metal Markets

New York, June 2—The metal markets continue to improve and there is increased buying by manufacturers in almost all lines. Confidence seems to be felt in the future, orders being placed for some time ahead.

Gold, Silver and Platinum

UNITED STATES GOLD AND SILVER MOVEMENT

Metal.	Exports.	Imports.	Excess.
Gold:			
April 1909..	$ 3,349,107	$ 6,337,994	Exp. $ 2,988,887
" 1908..	2,561,197	14,476,341	Exp. 11,915,144
Year 1909..	44,316,626	15,507,382	Exp. 28,809,244
" 1908..	18,335,344	19,857,221	Imp. 1,521,877
Silver:			
Apri 1909..	4,952,251	4,073,504	Exp. 878,747
" 1908..	4,462,564	3,467,926	" 994,638
Year 1909..	19,426,181	14,526,722	" 4,899,459
" 1908..	17,048,851	14,298.582	" 2,750,269

Exports from the port of New York, week ended May 29: Gold, $300,000, chiefly to Argentina; silver, $693,525, chiefly to London. Imports: Gold, $124,034; silver, $80,434, both principally from Central and South America.

Gold and silver movement in Great Britain, four months ended April 30:

	Imports.	Exports.	Excess.
Gold.....	£20,878,859	£14,472,579	Imp. £6,406,280
Gold, 1908...	16,824,776	11,455,953	Imp. 5,368,823
Silver.....	4,202,376	4,321,269	Exp. 118,893
Silver, 1908.	3,408,028	4,579,870	Exp. 1,171,842

Of the silver imported this year £3,574,425 came from the United States.

Gold and silver movement in France, three months ended March 31:

	Imports.	Exports.	Excess.
Gold.. Fr.	165,570,000	F.23,020,000	Imp.Fr.142,550,000
1908...	150,009,000	7,568,000	Imp. 142,441,000
Silver..	36,557,000	30,599,000	Imp. 5,958,000
1908...	31,120,000	43,519,000	Exp. 12,399,000

Imports of copper and nickel coins, 18,000 fr. in 1908, and 16,000 fr. in 1909; exports, 99,000 fr. in 1908, and 75,000 fr. this year.

Gold—There was no special demand for gold in the open market in London this week, and the prices continued unchanged at 77s. 9d. per oz. for bars and 76s. 4d. per oz. for American coin. Most of the gold was taken by the Bank of England, and for Austrian account. In New York $1,250,000 was taken today for shipment to Buenos Aires.

Platinum—Business has been rather slow, as is usual at this season. Prices are about 50c. lower, dealers quoting $22.50@23 for refined platinum, $25 for hard metal and $18@20 for scrap.

Silver—The market continues very steady, and indications point to small fluctuations for the present.

SILVER AND STERLING EXCHANGE

May-June.	27	28	29	31	1	2
New York....	52⅛	52⅞	53	....	53	52⅞
London.....	24⅛	24⅛	24¾	....	24¾	24⅝
Sterling Ex..	4.8785	4.8780	4.8780	....	4.8790	4.8785

New York quotations, cents per ounce troy, fine silver; London, pence per ounce sterling silver, 0.925 fine.

Exports of silver from London to the East, as reported by Messrs. Pixley & Abell, year to May 20:

	1908.	1909.	Changes.
India.... ...	£ 3,083,318	£1,938,300	D. £1,145,018
China.....	516,400	1,075,100	I. 558,700
Straits.....	90,200	82,800	D. 7,400
Total.....	£ 3,689,918	£3,096,200	D. £ 593,718

Imports for the week, £2000 from Chile, £7000 from the West Indies, £4000 from Mexico, £159,500 from New York; total, £172,500, Exports, £385,000 to India.

Copper, Tin, Lead and Zinc

May-June.	Copper. Lake, Cts. per lb.	Copper. Electrolytic, Cts. per lb.	Copper. London, £ per ton.	Tin. Cts. per lb.	Lead. New York, Cts. per lb.	Lead. St. Louis, Cts. per lb.	Zinc. St. Louis, Cts. per lb.
27	13¾ @13½	13½ @13¾	61	29⅛	4.30 @4.35	4.25 @4.30	5.07½ @5.10
28	13⅜ @13½	13½ @13¾	60⅞	29	4.35	4.25 @4.30	5.07½ @5.12½
29	13¾ @13⅝	13½ @13¾	....	29	4.35	4.25 @4.30	5.07½ @5.12½
31	.....	.....	....	....	.....	.....	.....
1	13¾ @13⅝	13½ @13⅝	60¼	29¼	4.35	4.25 @4.30	5.10 @5.12½
2	13¾ @13⅝	13½ @13⅝	60	29⅛	4.35	4.25 @4.30	5.10 @5.12½

London quotations are per long ton (2240 lb.) standard copper. The New York quotations for electrolytic copper are for cakes, ingots and wirebars, and represent the bulk of the transactions made with consumers, basis, New York, cash. The price of cathodes is usually 0.125c. below that of electrolytic. The quotations for lead represent wholesale transactions in the open market. The quotations on spelter are for ordinary Western brands; special brands command a premium.

Copper—While business continued very active and transactions were numerous and on a large scale during the early part of the week, the market has quieted down since prices were raised on June 1. The market closed steady at 13½@13⅝c. for Lake copper; 13⅛@13⅜c. for electrolytic in ingots, cakes and wirebars. The average for casting copper during the week was 13@13⅛ cents.

Copper sheets are 17c. base for large lots. Full extras are charged, and higher prices for smaller quantities. Copper wire has been advanced ¼c. to 14¾c. base, carload lots at mill. Business is good.

The standard market in London held firm until Tuesday, when a realizing movement of large proportions set in with the publication of an increase in statistics of 5400 tons. The close is lower and easy at £60 for spot, and £60 16s. 3d. for three months.

For refined and manufactured sorts we quote: English tough, £64; best selected, £63@64; strong sheets, £75@77.

At the beginning of May copper was on the basis of 13c. for Lake and 12½@12⅝c. for electrolytic. The important demand that developed at the end of April expanded during the first half of May and transactions became extraordinarily large. The volume of business was somewhat smaller during the second half of May, but continued large. The total sales for the month were very much in excess of the production. However, it is to be remarked that they covered deliveries extending several months ahead. At the beginning of May sellers were willing to make contracts for August delivery and some such transactions were made, but when the demand increased in strength the agencies generally refused to make contracts for later than July, except at an advance in price corresponding to carrying charges. At the end of May, however, some sales were being made for August delivery. The demand from domestic consumers improved very much during the month but at the end it appeared to be more or less satisfied, sales for near-by delivery being effected rather slowly. A large part of the transactions in May were speculative, there having been a rampant bull movement in the London market, emanating largely for this side. The superior advantages of speculating in copper, as compared with shares in the companies, was extensively urged. This speculation was a reminder of that which occurred last fall, when many outsiders took an interest in the market. Under these influences the price for standard copper in London was bid up above the parity of refined, and of course, the international houses took advantage of the opportunity to sell standard and deliver refined against their sales. As in the former case this implies an element of danger in the London market. At the best it indicates merely a transfer of a part of the accumulated stock. Indeed the European statistics at the end of May show an increase in the supply, while the American statistics, it is anticipated, will show a decrease. In the New York market there was a steady advance in price during May and at the close Lake copper was 13½c. and electrolytic 13 3/16 cents.

Exports of copper from the United States, four months ended April 30, are reported by the Bureau of Statistics at 88,940 long tons; this includes estimated contents of ore and matte, which were comparatively a small quantity. Exports for May are estimated at 31,423 tons, making a total of 120,363 tons for the five months.

Tin—The market in London remained very quiet. The only feature of interest which developed was the favorable statistics for the month of May which were published on June 1. The effect on quotations, however, was only minimum, and the small advance could not even be maintained. The market closes steady at £131 17s. 6d. for spot and £133 2s. 6d. for three months.

The domestic market moved in sympathy with the London market, attaining its high point on the first of the month, but closes somewhat easier at about 29⅞ cents.

Lead—The market is firm and the leading sellers have again advanced their price to the extent of $1 a ton, thus making the quotation at New York 4.35, while St. Louis is quoted at 4.25@4.30. Chemical lead has sold at St. Louis as high as 4.32½ cents.

The John Wahl Commission Company telegraphs us from St. Louis, under date of June 2, that lead is strong at the advance. Missouri brands are selling at 4.32½@4.35c. basis, East St. Louis.

The London market is again somewhat lower, the close being cabled at £13 2s. 6d. for Spanish and £13 5s. for English lead.

Spelter—The improvement in the steel and iron industry continues to exercise a favorable influence upon the price of spelter, and under the impetus of a good business, the market advanced to 5.10@5.12½c., St. Louis, 5.22½@5.27½c., New York.

The London market is firm, and the close is higher at £22 2s. 6d. for good ordinaries, £22 7s. 6d. for specials.

The John Wahl Commission Company telegraphs us from St. Louis, under date of June 2, that the latest sales of spelter have been on a basis of 5.15c., East St. Louis.

New York quotations for spelter, May 27, were 5.22½@5.25c.; May 28 and 29, 5.22½@5.27½c.; June 1 and 2, 5.25@5.27½ cents.

Base price of sheet zinc is 6¾c. per lb., f.o.b. La Salle-Peru, less 8 per cent. discount.

Other Metals

Antimony—The market has been dull. In the absence of large sales quotations are unchanged at 8⅜c. for Cookson's; 7⅞c. for U. S., and 7⅜@7⅝c. for outside brands.

Aluminum—Business is fair; otherwise there is no change. Prices are 22@24c. base for No. 1 ingots; 31@32c. base for wire; 33@34c. base for sheets.

Quicksilver—Business has been better, but New York prices are unchanged at $44.50 per flask of 75 lb. San Francisco, $44 for domestic orders and $42 for export. London price is £8 7s. 6d. per flask, but 5s. lower is quoted from second hands.

Nickel—Large lots, contract business, 40@50c. per lb. Retail, spot, from 50c. for 2000-lb. lots up to 55c. for 500-lb. lots. The price for electrolytic is 5c. higher.

Cadmium—Current quotation 75c. per lb., in 100-lb. lots, at Cleveland, Ohio.

Magnesium—Quotations for this metal are $1.25 per lb., New York, in 100-lb. lots; for 5-lb. lots, $1.40 per pound.

Imports and Exports of Metals

Exports and imports of metals in the United States, four months ended April 30, are reported as follows, in the measures usual in the trade:

Metals:	Exports.	Imports.	Excess.
Copper, long tons	88,940	48,577	Exp. 40,363
Copper, 1908....	124,406	27,219	Exp. 97,187
Tin, long tons....	129	14,332	Imp. 14,203
Tin, 1908.....	100	10,518	Imp. 10,418
Lead, short tons.	31,592	34,998	Imp. 3,406
Lead, 1908.....	26,832	37,768	Exp. 10,936
Spelter, sh. tons.	1,894	1,101	Exp. 793
Spelter, 1908....	1,167	267	Exp. 900
Nickel, lb.	3,653,202	6,255,032	Imp. 2,601,830
Nickel, 1908....	4,341,453	4,807,773	Imp. 466,320
Antimony, lb. ...	4,032	2,830,303	Imp. 2,826,271
Antimony, 1908.	2,616	2,624,131	Imp. 2,621,515
Platinum, oz.....	.....	39,995	Imp. 39,995
Platinum, 1908.	.....	12,388	Imp. 12,388
Quicksilver, lb	143,266	.....	Exp. 143,266
Quicksilver, '08	81,488	.....	Exp. 81,488
Aluminum, value	$150,735	.....	Exp. $150,735
Aluminum, 1908	137,316	.....	Exp. 137,316
Ores, etc.:			
Zinc oxide, lb...	9,701,223	.....	Exp. 9,701,223
Zinc oxide, '08..	8,919,325	.....	Exp. 8,919,325
Zinc dross, lb....	7,875,465	.....	Exp. 7,875,465
Zinc dross, '08..	9,077,781	.....	Exp. 9,077,781
Zinc ores, lg. tons	2,025	31,543	Imp. 29,518
Zinc ores, 1908.	10,118	10,900	Imp. 782
Antim'y ores, lb.	504	3,311,160	Imp. 3,310,656
Ant. ores, 1908.	.....	306,203	Imp. 306,203
Chrome ore, ...	.....	15,272	Imp. 15,272
Chrome ore, '08	.....	.....	.....

Copper, lead and nickel include the metal contents of ores, matte, bullion, etc. The exports given include reëxports of foreign material. Imports of zinc ores in 1909 included 21,230 tons calamine and 10,315 tons other ores, against 5104 and 5796 tons, respectively, in 1908. Chrome ore was not reported separately last year.

Zinc and Lead Ore Markets

Platteville, Wis., May 29—The highest price paid this week for zinc ore was $43; the base price, $40.50@$41 per ton of 60 per cent. zinc.. For 80 per cent. lead ore, $55@$56 per ton was paid.

SHIPMENTS, WEEK ENDED MAY 29.

Camps.	Zinc ore, lb.	Lead ore, lb.	Sulphur ore, lb.
Platteville	1,052,346	.....	249,000
Strawbridge	880,000	.....	.....
Cuba City	517,830	.....	160,000
Hazel Green	495,600	.....	.....
Benton	437,000	.....	.....
Livingston	380,000	.....	.....
Galena	88,000	.....	.....
Total	3,850,776	.....	409,000
Year to May 29	47,253,729	1,950,035	3,918,000

Highland, Linden, Harker are not reported. In addition to the above there was shipped to the American Zinc Ore Separating Company, 90,100 lb., and to the Joplin Separator Works, 409,000 lb. zinc concentrates.

There was shipped in the previous week, not then reported, from Highland, 65,800, from Linden, 56,220, from Harker, 77,750 and from Montfort, 40,000 lb. zinc ore; from Highland, 54,600 lb. lead ore.

Joplin, Mo., May 29—A sharp competitive market has advanced prices to $46 per ton for the highest grade of zinc sulphide ore. Offerings of $43.50 base were numerous, and ore is reported sold on flat bids at a price equivalent to a base of $44 per ton of 60 per cent. zinc. The base price for slimes, or sludge ore, was $38. Silicate of zinc ore sold on a base of $17 @19.50 per ton of 40-per cent. zinc, the highest sale being at $25.50. The average price, all grades, was $39.36. The high price for lead ore was $59, with medium grades selling at $57@58. The average price, all grades, was $57.86 per ton.

The zinc-ore market has been in a nervous and excitable condition all this month, and all efforts to establish any semblance of unity of price offerings by smelters, or of acceptance terms by sellers, have proved futile. For three weeks buyers have made purchases varying from $1 to $2 per ton for the same grade of ore. Instead of anticipating the advance sellers have been as greatly at sea as buyers.

SHIPMENTS, WEEK ENDED MAY 29.

	Zinc, lb.	Lead, lb.	Value.
Webb City Carterville	4,000,260	652,080	$100,914
Joplin	2,122,180	179,800	50,841
Prosperity	910,880	39,220	19,808
Galena	804,710	87,940	18,434
Duenweg	452,230	143,600	13,434
Aurora	543,710	48,480	10,405
Carthage	336,540	.....	7,066
Spurgeon	282,600	58,590	6,739
Granby	436,650	11,500	5,452
Shoalsburg-Saginaw	162,690	62,630	4,270
Alba-Neck	191,810	.....	3,931
Badger	162,690	.....	3,416
Oronogo	244,010	.....	3,376
Zincite	241,780	5,020	3,076
Carl Junction	114,100	5,300	2,544
Cave Springs	128,550	.....	2,635
Quapaw	95,180	14,940	2,287
Stott City	109,570	.....	2,246
Sarcoxie	106,000	.....	2,170
Totals	11,445,470	1,309,100	$263,044
Five months	249,361,660	40,097,510	$5,591,240
Zinc value, the week, $225,172;		5 mos.,	$4,528,006
Lead value, the week, 37,872;		5 mos.,	1,063,234

MONTHLY AVERAGE PRICES

Month.	Zinc Ore. Base Price.		Zinc Ore. All Ores.		Lead Ore. All Ores.	
	1908.	1909.	1908.	1909.	1908.	1909.
January	$37.60	$41.25	$35.56	$38.46	$46.88	$52.17
February	36.63	36.94	34.92	34.37	49.72	50.50
March	36.19	37.40	34.19	34.71	49.90	50.82
April	35.40	38.63	34.08	37.01	52.47	55.63
May	34.19	40.06	33.39	37.42	56.05	56.59
June	33.06	.....	32.07	.....	60.48	.....
July	34.55	.....	31.67	.....	59.90	.....
August	36.53	.....	33.42	.....	60.34	.....
September	37.63	.....	34.44	.....	54.59	.....
October	35.95	.....	33.28	.....	52.63	.....
November	39.13	.....	35.02	.....	54.53	.....
December	42.75	.....	39.63	.....	49.68	.....
Year	$36.63	.....	$34.31	.....	$53.93	.....

NOTE—Under zinc ore the first two columns give base prices for 60 per cent. zinc ore; the second two the average for all ores sold. Lead ore prices are the average for all ores sold.

Chemicals

New York, June 2—Current demand in most lines is for moderate sized lots. Heavy shipments are restricted chiefly to contract business.

Copper Sulphate—Sales are better and prices a little firmer. Quotations are, $4.25 per 100 lb. for carload lots, and $4.50 per 100 lb. for smaller orders.

Arsenic—Sales have been fair and quotations are a little higher, 2⅞@3c. being asked for white arsenic.

Nitrate of Soda—The market is good with many sales. Spot nitrate is steady at 2.25c.; futures are a shade lower, at 2.12½c., in view of good supplies reported afloat.

Imports and Exports—The imports and exports of chemicals and raw materials in the United States, four months ended April 30, were as follows:

	Imports.	Exports.	Excess.
Copper sulph. lb.	.....	1,873,866	E. 1,873,866
Bleach, lb.....	30,017,652	5,152	I. 30,012,500
Potash salts, lb..	133,685,384	1,374,219	I. 132,311,165
Soda salts, lb....	4,726,522	237,378	I. 4,489,144
Acetate lime, lb.	.....	32,085,786	E. 32,085,786
Nit. of soda, tons	116,562	2,709	I. 113,859
Phosphates, tons	3,997	340,206	E. 336,203
Sulphur, tons....	9,631	9,820	E. 189
Pyrites, tons.....	223,733	.....	I. 223,733

Exports include reëxports of foreign material. Estimating sulphur contents of pyrites, the total sulphur imported was approximately 99,124 long tons.

Mining Stocks

New York, June 2—After a holiday extending from Friday over to Tuesday the Stock Exchange opened rather strong and prices were well held on a good volume of trading. The most notable feature in the market continues to be the strength of Steel Corporation stocks, especially the common, which has advanced steadily and holds at a new record price. It is thought by many that this is an inside movement, but its object is not clearly apparent. Matters on the Exchange look very much as if preparations were being made for a strong bull movement.

On the Curb also there was an active market, but the movement was rather mixed, some stocks gaining over last week and others losing. Copper shares were in good demand and showed considerable buying, especially Nevada-Consolidated and Cumberland-Ely, while Ray Consolidated made a fair advance. In the Nevada stocks Goldfield Consolidated was heavily dealt in and some other stocks showed considerable strength. Some attention was also given to the Cobalt stocks, La Rose and Nipissing being the

leaders. There was some sales of Yukon Gold, but little change in price.

Boston, June 1—The week covers but four days of stock market, as the Saturday preceding and the Monday following May 30 were market holidays. Prices, however, have shown a gradual hardening tendency, and commission houses report increased business, which indicates that the public is taking an interest. The ease of money is a contributing cause, although there is room for improvement, market-wise.

Mass mining has been the feature, showing an extreme advance of $3.87½ to $18.25, but today it broke to close to $14 on selling from the Lake Superior district. Stop orders were reached which facilitated the decline. It seems that a mill-run test is being made on the recent strike of rich ore and precedent has established the rule that it is a good time to realize profits.

North Butte has been less of a market factor and selling pressure has been removed, for the time being at least. After stiffening $2.75 to $59, it fell back to $56.75 again. Calumet & Hecla is up $40 for the week to $675 per share, which cannot be construed any other way than favorable. Copper Range has been dull, although it showed animation today up to $82.25 on declaration of the usual quarterly dividend of $1 per share.

The Curb market has been principally in stocks that will sooner or later be taken over on the Stock Exchange list. As a rule, it has been firm in tone.

STOCK QUOTATIONS

NEW YORK	June 2
Name of Comp.	Clg.
Alaska Mine	.57
Amalgamated	85¾
Anaconda	51¼
Balaklala	‡2 1/16
British Col. Cop.	8⅝
Buffalo Mines	‡3½
Butte Coalition	27⅛
Colonial Silver	‡¼
Cum. Ely Mining	8 11/16
Davis-Daly	5 1/16
Dominion Cop.	.07
Douglas Copper	2 1/16
El Rayo	2
Florence	3⅛
Foster Cobalt	.32
Furnace Creek	.10
Giroux	7⅞
Gold Hill	⅛
Goldfield Con	7 1/16
Granby	‡104
Greene Gold	⅛
Greene G. & S.	9
Guanajuato	1⅝
Guggen. Exp.	195
Hanapah	.15
Kerr Lake	8⅛
McKinley Dar.	.85
Miami Copper	15
Micmac	¾
Mines Co. of Am.	⅛
Mitchell Mining	‡¾
Mont. Sho. C.	‡1 13/16
Nev. Utah M. & S.	2 1/16
Newhouse M. & S.	‡2⅛
Nipissing Mines	10⅞
Old Hundred	⅛
Silver Queen	.37
Stewart	1/16
Tennessee Cop'r.	41¾
Tri-Bullion	1/16
Union Copper	1⅛
Utah Apex	6½
Utah Copper	51⅛
Yukon Gold	5 1/16

*Ex. Div. †Ex. Rights.

BOSTON	June 2
Name of Comp.	Clg.
Adventure	9¼
Allouez	40
Am. Zinc	‡25⅛
Arcadian	5⅜
Arizona Com.	42⅜
Atlantic	9⅛
Boston Con.	15⅞
Calumet & Ariz.	104
Calumet & Hecla	675
Centennial	‡34
Copper Range	82
Daly-West	7½
East Butte	14
Franklin	16¾
Greene—Can.	10½
Hancock	11¼
Isle Royal	28½
Keweenaw	4¾
La Salle	14
Mass	15
Michigan	10¾
Mohawk	66
Nevada	23
North Butte	57
Ojibway	11½
Old Colony	‡.60
Old Dominion	‡55
Osceola	137
Parrot	35¼
Quincy	‡90
Rhode Island	‡4¾
Shannon	16
Superior	41½
Superior & Bost.	17¼
Superior & Pitts.	14⅜
Tamarack	71
Trinity	14
U. S. Smg. & Ref.	50
U.S. Sm. & Re., pd.	49¾
Utah Con.	42¾
Victoria	5
Winona	6
Wolverine	148
Wyandotte	3

‡Last quotation.

N. Y. INDUSTRIAL	
Am. Agri. Chem.	‡39
Am. Smelt. & Ref.	94
Am.Sm. & Ref., pf	‡109¾
Colo. Fuel & Iron.	41⅞
Federal M. & S.,pf.	‡91
National Lead	87
National Lead, pf.	108
Pittsburg Coal	12¾
Republic I. & S.	30
Republic I. & S.,pf.	97
Sloss-Sheffield	83¾
Standard Oil	676
U. S. Steel	65½
U. S. Steel, pf.	120½
Va. Car. Chem.	50¾

BOSTON CURB	Low.
Ahmeek	160
Black Mt.	.98
Chemung	17
Globe Con.	‡4⅛
Helvetia	6⅛
North Lake.	‡7½
Ray Central	3 1/16
Ray Con.	18
San Antonio	11½

Furnished by Hornblower & Weeks, N. Y.

ST. LOUIS	May 29	
N. of Com.	High.	Low.
Adams	.40	.30
Am. Nettie.	.08	.05
Center Cr'k	2.00	1.50
Cent.C.& C.	81.00	80.00
C.C. & C. pd.	80.00	79.00
Cent. Oil	110.00	100.00
Columbia	8.00	5.00
Con. Coal	20.00	19.00
Doe Run	110.00	100.00
Gra. Bimet.	.25	.20
St. Joe	12.00	11.00

LONDON	June 2		
Name of Com.	Clg.		
Dolores	£1	5s	0d
Stratton'sInd.	0	3	1½
Camp Bird	1	1	6
Esperanza	2	19	6
Tomboy	1	2	6
El Oro	1	6	3
Oroville	0	13	9

Cabled through Wm P. Bonbright & Co., N. Y

NEVADA STOCKS. June 2.

Furnished by Weir Bros. & Co., New York.

Name of Comp.	Clg.
COMSTOCK STOCKS	
Belcher	.50
Best & Belcher	.35
Caledonia	.09
Challar	.06
Comstock	.31
Con. Cal. & Va.	.66
Crown Point	.50
Exchequer	.25
Gould & Curry	.08
Hale & Norcross	.20
Mexican	.79
Ophir	1.20
Overman	.14
Potosi	.13
Savage	.19
Sierra Nevada	.28
Union	.31
Utah	.04
Yellow Jacket	.56
TONOPAH STOCKS	
Belmont	.78
Extension	.50
Golden Anchor	...
Jim Butler	.15
MacNamara	.22
Midway	.22
Montana	.68
North Star	.02
Tono'h Mine of N.	7.12½
West End Con.	.27
GOLDFI'D STOCKS	
Adams	.02
Atlanta	.14
Blue Bell	.03
Booth	.15
Columbia Mt.	.10
Comb. Frac.	.75
Con. Red Top	.02
Cracker Jack	.02½
Dia'dfield B. B. C.	.04
Goldfield Belmont	.04
Goldfield Daisy	.29½
Great Bend	.08
Jumbo Extension	.12
Kendall	.04
Lone Star	.04
May Queen	.04
Oro	.08
Red Hill	.08
Roanoke	...
Sandstorm	.10

Name of Comp.	Clg.
Silver Pick	.16
St. Ives	.10
Triangle	01½
BULLFROG STOCKS	
Gibraltar	.03
Homestake King.	.01
Mont. Shoshone C.	1 87½
Tramp Cons.	.06
MISCELLANEOUS	
Bonnie Clare	...
Lee Gold Grotto	...
Nevada Hills	1.12½
Nevada Smelting.	.87½
Nevada Wonder	.50
Nevada-Utah	2 37½
Penn-Wyoming	.04
Pittsburgh S. Pk.	.50
Rawhide Caol't'n.	...
Round Mt. Sphinx	10

COLO. SPRINGS	May 28
Name of Comp.	Clg.
Acacia	.07
Black Bell	....
C. C. Con	.03½
Dante	‡.06
Doctor	.08¾
Elkton	.63
El Paso	.47½
Findlay	‡.15
Gold Dollar	.11½
Gold Sovereign	‡.03
Isabella	.20½
Jack Pot	.06¾
Jennie Sample	‡.07
Jerry Johnson	‡.05¾
Mary McKinney	.38
Pharmacist	.03½
Portland	.89
Un. Gold Mines	.05¾
Vindicator	.57
Work	‡.06¼

Assessments

Company.	Delinq.	Sale.	Amt.
Blue Wing, Ida	May 8	June 5	$0.005
Bullion, Nev.	June 14	July 13	0.05
Challenge Con., Nev	June 22	July 13	0.05
Challar, Nev.	June 8	June 30	0.10
Confidence, Nev.	May 18	June 8	0.20
Con. Imperial, Nev.	May 26	June 17	0.01
Dalton M. & M., Utah	May 26	June 9	0.00½
Echo, Ida.	May 1	June 1	0.002
Exchequer, Nev.	May 5	May 26	0.05
Gould & Curry, Nev.	June 8	June 26	0.10
Hecla M. & M., Utah	May 15	June 14	0.05
Julia Con., Nev.	May 24	June 17	0.03
Laclede, Ida.	Apr. 7	May 1	0.003
Mexican, Nev	June 28	July 14	0.10
Nev. Superior	Apr. 10	May 1	0.07½
Palmyra G. & C., Utah	June 11	June 30	0.001
Reindeer C. & G., Ida.	Apr. 28	May 28	0.005
Scorpion, Nev.	June 14	July 6	0.02
Sierra Nevada, Nev.	May 4	May 25	0.10
Uintah Treas. Hill, Utah	May 20	June 9	0.01
Union Con., Nev.	June 28	July 19	0.10

Monthly Average Prices of Metals

SILVER

Month.	New York.		London.	
	1908.	1909.	1908.	1909.
January	55.678	51.750	25.738	23.834
February	56.000	51.472	25.855	23.706
March	55.365	50.468	25.570	23.227
April	55.505	51.428	25.133	23.708
May	52.795	52.905	24.377	24.343
June	53.663	.....	24.760	.....
July	53.115	.....	24.514	.....
August	51.683	.....	23.858	.....
September	51.720	.....	23.877	.....
October	51.431	.....	23.725	.....
November	49.647	.....	22.933	.....
December	48.766	.....	22.493	.....
Year	52.864	.....	24.402	.....

New York, cents per fine ounce; London, pence per standard ounce.

COPPER

	NEW YORK.				LONDON.	
	Electrolytic		Lake.			
	1908.	1909.	1908.	1909.	1908.	1909.
January	13.726	13.893	13.901	14.280	62.386	57.688
February	12.905	12.949	13.098	13.295	58.786	61.198
March	12.704	12.387	12.875	12.826	58.761	56.231
April	12.743	12.56¼	12.928	12.93¾	58.331	57.363
May	12.598	12.893	12.788	13.228	57.387	.....
June	12.675	.....	12.877	.....	57.842	.....
July	12.702	.....	12.933	.....	57.989	.....
August	13.462	.....	13.639	.....	60.500	.....
September	13.388	.....	13.600	.....	60.338	.....
October	13.354	.....	13.646	.....	60.139	.....
November	14.130	.....	14.386	.....	63.417	.....
December	14.111	.....	14.411	.....	62.943	.....
Year	13.208	.....	13.424	.....	59.902	.....

New York, cents per pound. Electrolytic is for cakes, ingots or wirebars. London, pounds sterling, per long ton, standard copper.

TIN AT NEW YORK

Month.	1908.	1909.	Month.	1908.	1909.
January	27.380	28.060	July	29.207	.....
February	28.978	28.290	August	29.942	.....
March	30.577	28.727	September	28.815	.....
April	31.702	29.445	October	29.444	.....
May	30.015	.....	November	30.348	.....
June	28.024	.....	December	29.154	.....
			Av. Year.	29.465	.....

Prices are in cents per pound.

LEAD

Month.	New York.		St. Louis	London.	
	1908.	1909.	1909.	1908.	1909.
January	3.691	4.175	4.025	14.469	13.113
February	3.725	4.018	3.868	14.250	13.313
March	3.838	3.986	3.835	13.975	13.458
April	3.993	4.168	4.051	13.469	13.297
May	4.253	4.287	4.214	12.938	.....
June	4.466	.....	.....	12.600	.....
July	4.744	.....	.....	13.000	.....
August	4.580	.....	.....	13.375	.....
September	4.515	.....	.....	13.125	.....
October	4.351	.....	.....	13.375	.....
November	4.330	.....	.....	13.538	.....
December	4.213	.....	.....	13.156	.....
Year	4.200	.....	.....	13.439	.....

New York and St. Louis, cents per pound. London, pounds sterling per long ton.

SPELTER

Month.	New York		St. Louis.		London.	
	1908.	1909.	1908.	1909.	1908.	1909.
January	4.513	5.141	4.363	4.991	20.563	21.425
February	4.788	4.889	4.638	4.739	20.875	21.563
March	4.665	4.757	4.527	4.607	21.075	21.438
April	4.645	4.965	4.495	4.815	21.344	21.531
May	4.608	5.124	4.458	4.974	19.906	.....
June	4.543	.....	4.393	.....	19.000	.....
July	4.485	.....	4.338	.....	19.031	.....
August	4.702	.....	4.556	.....	19.350	.....
September	4.769	.....	4.619	.....	19.563	.....
October	4.801	.....	4.651	.....	19.750	.....
November	5.059	.....	4.909	.....	20.875	.....
December	5.137	.....	4.987	.....	20.625	.....
Year	4.726	.....	4.578	.....	20.163	.....

New York and St. Louis, cents per pound. London in pounds sterling per long ton.

THE MINING INDEX

The editors of this paper read all the important publications of the world that relate to mining and the treatment of minerals. This index is published as a reference for all interested and to make it impossible for readers of the ENGINEERING AND MINING JOURNAL to miss any important article published anywhere.

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ALUMINUM

9365—WELDING—Aluminum Welding. M. U. Schoop. (Electrochem. and Met. Ind., May, 1909; 2 pp.) Notes on the applications of aluminum welding and description of the most suitable type of burner. Illustrated. 40c.

ANTIMONY

9366 — METALLURGY AND USES of Antimony. E. B. Wilson. (Mines and Minerals, May, 1909; 2 pp.) Notes on the use of antimony; its ores, methods of testing; wet and fire assays and metallurgical processes. 20c.

ASBESTOS

9367 — QUEBEC ASBESTOS: World's Supply Controlled. Alex Gray. (Min. Journ., Apr. 3, 1909; 1 p.) Statistics on the asbestos industry in Canada; the names of the companies in the asbestos combine, together with notes on prices and markets. 40c.

ASPHALTUM

9368—GRAHAMITE DEPOSITS of Southeastern Oklahoma. Joseph A. Taff. (Bull. No. 380-H, U. S. Geol. Surv., 1909; 12 pp.) Notes on the location and occurrence of grahamite in southeastern Oklahoma, together with a review of the geology of the district.

9369—NEVADA—An Occurrence of Asphaltite in Northeastern Nevada. Robert Anderson. (Bull. No. 380-H, U. S. Geol. Surv., 1909; 3 pp.) Some notes on the occurrence and character of asphaltite as found in Northeastern Nevada.

9370—WEST AFRICA—Bitumen and Oils in West Africa. T. Hugh Boorman. (Eng. and Min. Journ., May 22, 1909; 1 p.) A brief report on the occurrence of bitumen in Nigeria with analyses in which it is compared with that of Trinidad and Bermudez. 20c.

BORAX

9371—CALIFORNIA—Borate Deposits of California. Wilfred B. Wainewright. (Trans. Manchester Geol. and Min. Soc., Part IV. Vol. XXXI, 1908-1909; 7 pp.) A short description of the mineral deposits, together with notes on the refining of crude borax.

CALCIUM CARBIDE

9372—MANUFACTURE of Calcium Carbide. (Engineering, Apr. 2, 9, 16 and May 7, 1909; 8 pp.) Continuation of article previously indexed, describing the installation and operation of the electric generating plant, and general arrangement of the works at Odda, Norway. Also gives details of the cableway used in handling raw material, the carbide furnaces, crushing machinery and the manufacture of drums and barrels for the finished product. $1.40.

CEMENT

9373—COLORADO—The Niobrara Limestone of Northern Colorado as a Possible Source of Portland Cement Material. G. C. Martin. (Bull. No. 380-J., U. S. Geol. Surv., 1909; 13 pp.) Notes on the general geologic features of the district; requirements for cement materials; a description of the material occurring near Ft. Collins, Colorado, together with analyses of cement rock.

9374—COMPOSITION AND CHARACTERISTICS of Cement. Alfred C. Crider. (Min. Sci., Apr. 8, 1909; 2 pp.) Some notes on the history, advancement, uses and various forms of cement. Illustrated. 20c.

9375—MONTANA—Cement Material Near Havre., Mont. Leon J. Pepperberg. (Bull. No. 380-J, U. S. Geol. Surv., 1909; 9 pp.) Notes on the geology of the district and composition of cement materials. Also notes on the economic conditions.

9376—PORTLAND CEMENT. John L. Howard. (Min. and Sci. Press, May 1, 1909; 4½ pp.) An historical review of the cement industry, together with notes on tests for soundness, fineness, tensile strength and compressive strength. 20c.

9377—TESTING—Standard Methods of Testing Cement. Carney Hartley. (Min. Sci., May 13, 1909; 3 pp.) An article dealing with the importance of a proper test of the cement prior to use, giving specifications for cement and the method of determining quality. Illustrated. 20c.

CLAYS

9378—FLORIDA—Notes on the Clays of Florida. George C. Matson. (Bull. No. 380-K, U. S. Geol. Surv., 1909; 24 pp.) A description of the clays of different geologic periods together with a number of chemical analyses. Also a description of the mining method and manufacturing processes.

COAL AND COKE

9379—ALBERTA—Coal Mining in Alberta During the Year 1908. (Can. Min. Journ., May 15, 1909; 3½ pp.) A review of the mining industry in Alberta during 1908; the development of old mines and the opening of new ones, and the names of the principal operating companies. Illustrated. 20c.

9380—ANALYSIS of the Subject of Coal Analysis. N. W. Lord. (Power, Apr. 13, 1909; 3 pp.) A discussion of the chief things coal users wish to know, with notes on the value of the various methods used in analyzing coal. Paper before the Illinois Fuel Conference at Urbana, March 13. 20c.

9381—BITUMINOUS COAL—Methods of Firing Cheap Grades of Bituminous Coal. William Kavanagh. (Elec. Wld., May 6, 1909; 1 p.) A discussion of six different methods for firing with soft coal, with notes on the advantages of each. Illustrated. 20c.

9382—BRIQUET-MAKING. W. Galloway. (Proc. South Wales Inst. Engrs., Vol. XXVI, 1909; 47 pp.) Statistics and a general description of the process of briquetting, together with notes on the cost of installation and operation. A short description of a briquet plant at the Holland colliery, Westphalia. Illustrated.

9383—COAL CUTTING MACHINES—A Comparison of Coal-cutting Machines. Sydney F. Walker. (Eng. and Min. Journ., May 22, 1909; 4½ pp.) Notes in which various coal cutting machines are compared; a statement of costs which show the economy of machine mining; a discussion of compressed air as compared with electric power. 20c.

9384—COAL DUST to Date, and Its Treatment with Calcium Chloride. Henry Hall. (Trans. Min. Inst. of Scotland, Vol. XXXI, Part 4, 1908; 36 pp.) A short review of coal dust literature; tests of coal dust in airways; effects of watering; effects of calcium chloride treatment of dust and a description of the method of its application.

9385—COAL DUST PROBLEM, The. John Verner. (Mines and Minerals, May, 1909; 3¼ pp.) Discusses the mechanical influence of air currents in furnishing conditions favorable to dust explosion. Illustrated. 20c.

9386—COKE—Donohoe Coke Company. C. R. King. (Mines and Minerals, May, 1909; 4 pp.) A description of the plan of the works and mine; arrangements for economic expansion and contraction of output; and notes on the managing of the liquor question. Illustrated. 20c.

9387—COKE—Koppers By-Product Coke Oven Plant at Joliet. R. Gunderson. (Progressive Age, May 1, 1909; 2¼ pp.) A general description of a plant of 280 by-product coke ovens now in use at the works of the Illinois Steel Company. Illustrated. 20c.

9388—COKE—The Genesis and Development of the Coking Oven. W. Galloway. (Proc. South Wales Inst. Engrs., Vol. XXVI, 1909; 12 pp.) An historical review of the coke industry covering a period of over 200 years. Illustrated.

9389—COLORADO—The Grand Mesa Coal Field, Colorado. Willis T. Lee. (Bull. No. 341-C, U. S. Geol. Surv., 1909; 20 pp.) General notes on the geology and geography of the district, together with short descriptions of some of the local deposits. Illustrated.

9390—COLORADO AND NEW MEXICO—The Coal Field Between Durango, Colorado, and Monero, New Mexico. James H. Gardner. (Bull. No. 341-C, U. S. Geol. Surv., 1909; 13 pp.) A short description of the geology of the district, together with some notes on the various coal beds. Illustrated.

9391 — COLORADO AND UTAH — Coal Fields of Northwestern Colorado and Northeastern Utah. H. S. Gale. (Bull. 341-C, U. S. Geol. Surv., 1909; 35 pp.) A prelimary statement of the results of investigations in these fields during 1907, dealing with their geology, and giving a detailed description of the coal fields, illustrated by geologic maps.

9392—COST OF MINING—An Investigation of the Cost of Mining Coal. J. R. Finlay. (Eng. and Min. Journ., May 8, 1909; 3½ pp.) An analysis of the operating cost in which it is shown that the rate of wages is an effect and not a cause in the economy of mining. 20c.

9393—ELECTRICAL PLANTS—Notes on Safety of Working Electrical Plants in Coal Mines. S. A. Simon. (Electrician, Apr. 9, 1909; 2 pp.) A consideration of the precautions necessary in installing and employing electrical apparatus in mines, with notes on tests carried out some years ago in Europe to determine the value of enclosing electrical conductors as a protection against explosion. Illustrated. 40c.

9394—EXPLOSION—Notes on the Norton Hill Colliery Explosion. H. M. Morgans. (Eng. and Min. Journ., May 15, 1909; 1⅔ pp.) A discussion of the action of fire damp and coal dust in mine explosions, with comments on the mine inspector's report of the disaster. 20c.

9395—EXPLOSIONS—Mine Explosions as Related to Earthquakes. W. A. Spalding. (Eng. and Min. Journ., May 1, 1909; ½ p.) A supplemental list of coincidences and close approximations of earthquakes and mine explosions. 20c.

9396—EXPLOSIVES—Relation of the Use of Powder to Mine Accidents. (Black Diamond, May 15, 1909; 1¾ pp.) Statistics on the use of powder in mines showing that an excess of powder invariably results in greater fatalities. Illustrated. 20c.

9397—GEOLOGY—Petroleum and Coals. Eugene Coste. (Can. Min. Journ., May 15, 1909; 5 pp.) A discussion of petroleum and coal; a comparison of their nature, mode of occurrence and origin. To be continued. 20c.

9398—GREAT BRITAIN—The Wemyss Coal Field. John Gemmell. (Trans. Min. Inst. Scot., Vol. XXXI, Part 4, 1908; 19 pp.) An historical review of the coalfield, and modern development, along the line of exploration, shaft sinking and pumping machinery.

9399—HOISTING—A Welsh Electric Hoisting Plant. A. H. Bridge. (Elec. Rev., May 15, 1909. 2 pp.) A description of an electric hoisting plant operating in South Wales at the Maritime Pit of the Great Western Colliery Company, capacity 175 tons per hour from a depth of 1100 ft. Illustrated. 20c.

9400—HOISTING—Three Thousand Horse Power Winding Engine. J. B. Van Brussel. (Eng. and Min. Journ., May 1, 1909; 1⅛ pp.) The description of a winding engine plant recently installed in an English colliery near Brussels. Illustrated. 20c.

9401—ILLINOIS—The Carterville Coal Field, Southern Illinois. R. S. Moss. (Min. Wld., Apr. 10, 1909; 2 pp.) An historical review of coal mining in Southern Illinois, together with a description of a number of the principal mines, including the washer and tipple of the Madison Coal Corporation. Illustrated. 20c.

9402—INDIA—Longwall Working at the Seeterampore Coal Company's Collieries, Nursamooda, India. Willis Howarth. (Iron and Coal Tr. Rev., Apr. 30, 1909; 1 p.) A discussion of the longwall method of mining in India, with special reference to the physical conditions of the locality, the human conditions and the mechanical conditions which confront the engineer in charge. Illustrated. 40c.

9403—MONTANA—The Coal-mining Industry of Montana. J. P. Rowe. (Eng. and Min. Journ., Apr. 24, 1909; 5½ pp.) A review of each property in the district, together with a scale of day wages and schedule of mining rates. Illustrated. 20c.

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MINING AND METALLURGICAL MACHINERY

9618—AIR COMPRESSOR TESTS. W. A. MacLeod and J. P. Wood. (Proc. Aust. Inst. Min. Eng., Feb., 1909; 3 pp.) This is a continuation of a previous paper and gives additional indicator cards indicating the performance of a machine after 15 months of steady running. Illustrated.

9619—BOILER WATER—Feed Water Heaters as Purifiers. J. C. William Greth. (Industrial Engineering, April, 1909; 8 pp.) Heat and its relation to the purification of water for industrial uses, especially boiler feed, is discussed, together with tabulated results of laboratory experiments. 40c.

9620 — BOILER WATER — The Technical Examination of Boiler Waters. W. A. Hargreaves. (Eng. News, May 20, 1909; 1 p.) A description of a scheme which permits of rapid examinations with an accuracy very closely approximating that given by a detailed analysis by ordinary methods. 20c.

9621—CONVEYERS—Transporters, Elevators and Conveyers. Edward Butler. (Eng. Rev., April, 1909; 6 pp.) Continuation of article previously indexed. The author here describes the single and double chain automatic grabs, and gives a number of illustrations showing their mechanical construction. 40c.

9622—CONVEYING MACHINERY — A Unique Belt Conveyer. E. C. Soper. (Journ. A. S. M. E., May, 1909; 8 pp.) A description of a belt conveyer one quarter of a mile long used for the handling of Portland cement material. Illustrated.

9623—CONVEYING MACHINERY—Automatic Feeders for Handling Material in Bulk. C. Kemble Baldwin. (Journ. A. S. M. E., May, 1909; 9 pp.) This paper presents a brief description of the various types of automatic feeders now in use including the undercut-gate, lifting gate, screw conveyer, roll and plunger feeders. Illustrated.

9624—CONVEYING MACHINERY—Mechanical Appliances Used on the Mines of Western Australia. W. G. Manners. (Monthly Journ. W. A. Chamber of Mines, Feb. and Mar., 1909; 9½ pp.) Notes on the transportation of material by mechanical means, with special reference to launders, rope haulage and belt and push conveyers. Illustrated. $1.40.

9525 — CONVEYING MACHINERY — Modern Material-Handling Machinery for Industrial Plants—I. A. G. A. Schmidt. (Ind. Eng., April, 1909; 26 pp.) A discussion of chain blocks, derricks, I-beam systems, traveling cranes, locomotive cranes, with some notes on coal storage systems. Illustrated. 40c.

9626—ELECTRIC POWER PLANT—Electrical Devices in Modern Mining. (Eng. Journ. of Canada, Apr., 1909; 1 p.) A description of the power plant of the Copper Cliff mine, Canada, at which electricity is extensively employed to the extent of over 5000 horsepower. 20c.

9627—FUEL ECONOMIZERS—Eliminating Waste in Steam Generation. Carl S. Dow. (Industrial Engineering, April, 1909; 7 pp.) A discussion and description of the Sturtevant economizer and the Green fuel economizer. Illustrated. 40c.

9628—GAS POWER—The Value of Gas Power. Charles E. Lucke. (Can. Engr., Apr. 23, 1909; 5 pp.) A discussion of the efficiency of gas engines; notes on producer gas together with data on the cost of power and power plants. 20c.

9629 — GAS PRODUCER PLANTS — Suction Gas Producer Plants and Their Application in South Africa. H. W. Miller. (Journ. Transvaal Inst. Mech. Engrs., March, 1909; 22 pp.) A detailed description of the suction gas producer plant, and analyses of South African coals. Also notes on the utilization of the gas for engine driving. Illustrated. 60c.

9630—HYDRO ELECTRIC PLANTS—The Design of Steel Pipes for Hydro-Electric Plants. Richard Muller. (Eng. Rec., May 1, 1909; 1⅔ pp.) A mathematical discussion of the design of steel water pipes to be used under heavy pressure. Illustrated. 20c.

9631—LIQUID FUEL BURNING ARRANGEMENTS for Steam Boilers. (Mechn. Engr., Apr. 23, 1909; 1½ pp.) A description and illustrations of several arrangements for burning liquid fuel in steam generators. Illustrated. 20c.

9632—POWER TRANSMISSION—Leather Belting and Rope Drives Compared. (Eng. Journ. of Canada, Apr., 1909; 3 pp.) A discussion of conditions under which both forms of drives should be employed. A practical consideration of the problem which is the best general form of drive. 20c.

9633—PRODUCER GAS—The Combustion of Producer Gas. Oskar Nagel. (Electrochem. and Met. Ind., May, 1909; 3½ pp.) Notes on high efficiency of combustion, thoroughness of gas-air mixture and preheating the air. 40c.

9634—PUMPS—Centrifugal Pump Efficiency. V. V. Messer. (Min. and Sci. Press, May 15, 1909; 2½ pp.) Notes on the construction, cost and efficiency of centrifugal pumps. Illustrated. 20c.

9635 — PUMPS — Electrically Operated Centrifugal Pumps in Belgium. Frank C. Perkins. (Min. Sci., Apr. 8, 1909; 2 pp.) A description of the type, construction and pressure of pumps driven by electric power. Illustrated. 20c.

9636—PUMPS—Sinking Pumps. Frank S. Mitchell. (Journ. Assn. Eng. Soc., March, 1909; 4 pp.) A short description of a sinking pump in which the inventor endeavors to have the fewest parts; well protected; minimum weight, giving a continuous flow in one direction by means of a differential plunger. Illustrated. 40c.

9637—PYROMETER—The Bristol Recording Pyrometer. Percy Longmuir and Thomas Swinden. (Iron and Steel Institute, May, 1909; 12 pp.) Notes on the installation of pyrometer and tests to ascertain the behavior of pyrometer under normal working conditions in hot blast temperatures. Illustrated.

CHEMICALS, MINERALS, RARE EARTHS, ETC.—CURRENT WHOLESALE PRICES.

ABRASIVES—		
Borts, good drill quality, carat.		$85.00
Carborundum, f.o.b. Niagara Falls, powd.	lb.	.08
Grains	"	.10@.17
Corundum	"	.07@.10
Crushed Steel, f.o.b. Pittsburg	"	.05½@.06
Emery, in kegs; Turkish flour	"	.01½@.02
Grains	"	.03½@.04
Naxos flour	"	.01½@.02
Grains	"	.03½@.04
Chester flour	"	.01½@.02
Grains	"	.03½@.04
Peekskill flour, f. o. b. Easton, Pa.	"	.01½@.01¾
Grains, in kegs	"	.02½@.03
Garnet, per quality	sh. ton.	25.00@35.00
Pumice Stone, Am. Powd.,	100 lb.	1.60@2.00
Italian, powdered	per lb.	.01¾@.01¾
Lump, per quality	"	.05@.30
Rottenstone, ground	"	.02½@.04
Lump, per quality	"	.05@.30
Rouge, per quality	"	.05@.30
Steel Emery, f.o.b. Pittsburg	"	.07½@.07¾
ACIDS—		
Acetic 28%	lb.	.02¾ up
Boric	"	.07
Hydrofluoric, 30%	"	.02¾@.03½
" 48%	"	.06
" 60%	"	.10
Hydrochloric acid, 20°	per lb.	1.25@1.50
Nitric acid, 38°	per lb.	.04½@.04½
Sulphuric acid, 50°, bulk	per ton.	$12 up
60°, 100 lb. in carboys		.85@1.12½
60°, bulk, ton		16.00@18.00
66°, 100 lb. in carboys		1.00@1.10
66°, bulk, ton		18.00
Oxalic	per lb.	.06½@.07
ALCOHOL—Grain 95%	gal.	2.64
Denatured	"	.45@.47
Refined wood, 95@97%	"	.50@.55
ALUM—Lump	100 lb.	$1.75
Ground	"	1.85
Chrome Alum	"	.03¾@.05
ALUMINUM—Sulphate, com'l	lb.	1.50@1.75
AMMONIA—24 deg. lb	"	.04½@.05¾
" 26 deg. lb	"	.04¾@.05¾
AMMONIUM—		
Bromide	lb.	.28
Carbonate	"	.07¾@.09½
Muriate grain	"	.05½@.06½
Lump	"	.09½@.09½
Sulphate, 100 lb.		2.85@2.90
Sulphocyanide com	"	.30
" " chem. pure	"	.40
ANTIMONY—needle, lump	"	.03½@.04
ARSENIC—White	"	.02½@.03
Red	"	.07½@.08
ASPHALTUM—		
Barbadoes	per ton.	40.00@80.00
West Indies	"	20.00@60.00
Egyptian	lb.	.09@.10
Gilsonite, Utah ordinary	per ton.	32.00
Trinidad	"	20.00@25.00
California	"	22.00@28.00
BARIUM—		
Carb. Lump, 80@90%	lg. ton.	30.00@35.00
Precipitated 96@98%		36.00@40.00
Powdered, 80@90%	lb.	.02@.02½
Chloride com'l	ton.	37.00@39.00
Nitrate powdered, in casks	lb.	.05½@.06½
Blanc Fixe, dry, bbl	per lb.	.02½@.04
BARYTES—		
Am. Ground	sh. ton.	12.00@17.00
Floated	"	17.00@20.00
Foreign floated	"	20.00@22.00
BISMUTH—Sub-nitrate	lb.	1.40@1.45
BLEACHING POWDER—35%, 100 lb.		1.25@1.50
BLUE VITRIOL—copper sulphate), carload, per 100 lb.		4.25@4.50
BONE ASH	lb.	.02½@.04
BORAX, sacks	"	.04½@.05
CALCIUM—Acetate, gray, 100 lb		1.75@1.80
Carbide, ton lots f.o.b. Niagara Falls, N. Y., for Jersey City, N. J.	sh. ton.	65.00
Chloride, f.o.b. N. Y.	"	11.00@14.00
CEMENT—		
Portland, Am. 500 lb	bbl.	1.50@1.60
Foreign	"	2.25@2.90
"Rosendale," 300 lb.	"	.85
(in sacks)	"	.65
Slag cement	"	.75@1.25
CHROME ORE—		
New Caledonia 50% ex. ship N. Y.	per lg. ton.	14.00@16.00
Bricks, f.o.b. Pittsburg, per M.		175.00
CLAY, CHINA—Am. common ex-dock, N. Y.	ton.	7.00@10.00
Foreign	"	10.00@17.50
COBALT—Oxide	lb.	1.10@1.50
COPPERAS—Bulk	100 lb.	$0.55
In bbls	"	.65@.75
In bags	"	.60@.70
CRYOLITE	lb.	.06½@.06¾
FELDSPAR—Ground	sh. ton.	8.00@12.00
FIRE BRICK—		
American	per M.	30.00@40.00
Imported	"	30.00@45.00
St. Louis	"	16.00
Extra	"	20.00@23.00
Special extra	"	30.00@35.00
FIRE CLAY—F.o.b. St. Louis.		
St. Louis, extra quality	per ton.	5.00
" ordinary	"	2.50
FLUORSPAR—		
Domestic f.o.b. shipping port:		
Lump	lg. ton.	8.00@10.00
Ground	"	12.00@14.00
Foreign crude ex. dock		8.00@10.00
FULLER'S EARTH—Lump,	100 lb.	.80@.85
Powdered	"	.80@.85
GRAPHITE—Ceylon.		
Flying dust, finest to best	lb.	.02½@.04
Dust	"	.02½@.05
Chip	"	.04@.08
Lump	"	.05½@.12
Largel ump	"	.08¼@.10½
GYPSUM—		
Fertilizer	sh. ton.	5.00
Ground	"	4.00@7.00
INFUSORIAL EARTH—		
Ground Am. Best	lb.	.01¾@.02½
German	lb.	.02½@.02¾
LEAD—Acetate (sugar of) brown,	lb.	.07¾@.08
Nitrate, com'l	"	.07⅞@.08¼
MAGNESITE—Greece.		
Crude (95%)	lg. ton.	7.50@8.50
Calcined, powdered	sh. ton.	30.00@35.00
Bricks, domes, per qual. f.o.b. Pittsburg	M.	160@200
MAGNESIUM—		
Chloride, com'l	100 lb.	.90@1.25
Sulphate (Epsom salt)	100 lb.	.90@1.00
foreign		
MANGANESE—		
Foreign, crude, powdered:		
70@75% binoxide	lb.	.01@.01½
75@85% binoxide	"	.01½@.01½
85@90% binoxide	"	.01½@.05
90@95% binoxide	"	.06½
Ore, 80%-85%	sh. ton.	16.00@32.50
MARBLE—Flour	sh. ton.	8.50@9.00
MINERAL WOOL—		
Slag, ordinary	sh. ton.	19.00
Selected	"	25.00
Rock, ordinary	"	32.00
MONAZITE SAND—		
Guar. 97%, with 5% Thorium oxide, nominal	lb.	.08 and up
NICKEL—		
Oxide, crude, lb. (77%) for fine metal contained		.47
Sulphate, single	lb.	.09@.11
Sulphate, double	"	.06½@.08
NITRATE OF SODA—		
100 lb. 95%		2.25
95% for 1910		2.25
96% is 2½@7½c. higher per 100 lb.		
OZOKERITE—best	lb.	.14@.17
PAINTS AND COLORS—		
Litharge, Am. powdered	lb.	.05½@.06½
English glassmakers'	"	.08¾@.08¾
Lithopone	"	.03¾@.07
Metallic, brown	sh. ton.	16.50@22.00
Red	"	14.00@18.00
Ocher, Am. common	"	8.50@9.00
Best	"	16.00
Dutch, washed	lb.	.02¾@.03
French, washed	"	.01½@.02
Paris green, pure, bulk	"	.21½
Red lead, American	"	.06@.06½
Foreign	"	.08½@.08¾
Turpentine, spirits bbl., per gal.		.42@.43
White lead, Am., dry	"	.05½@.05½
American, in oil	"	.06½@.07
Foreign, in oil	"	.10½@.10¾
Zinc white, Am. extra dry	"	.05½@.05½
French, proc's, red seal, dry	"	.06¾@.07
French, process, green seal, dry	"	.07½@.07½
PHOSPHATES—Acid	57@60c. per unit	
*Fla., hard rock 77%		7.50@8.00
land pebble 68%		3.75@4.00
†Tenn., 78@80%		5.00@5.50
75%		4.75@5.00
68@72%		4.25@4.50
‡So. Car. land rock 60%		3.50@4.00
POTASSIUM—		
Bicarbonate crystal	lb.	$.08½@.09
Powdered or granulated	"	.08½@.08¾
Bicromate, Am.	"	.08¾@.08¾
Scotch	"	.10½
Bromide	"	.20
Carbonate (80@85%)	"	.03¾@.04
Caustic, ordinary	"	.06½@.06¾
Elect. (90%)	"	.05½@.06
Chloride (muriate), 100 lb.		1.90
Chlorate, powdered	"	.09½@.09¾
Crystals	"	.09@.09½
Cyanide (98@99%)		
Carloads (30,000 lb.)	"	18c.
5-ton lots		18½c.
Less than 5 tons		.20@.22½
Kainite, long ton, bulk, 8.50; bags, 9.50.		
Permanganate	lb.	.09½@.10½
Prussiate, yellow	"	.13@.13½
Red	"	.30@.33
Sulphate (basis 90%)	100 lb.	2.18@2.21
PYRITE—		
Domestic, non-arsenical, furnace size, f.o.b. mines	per unit.	11@11½c.
Domestic, non-arsenical, fines, per unit, f.o.b. mines		10@10½c.
Imported, non-arsenical, furnace size, per unit		.12@.12½
Imported, arsenical, furnace size, per unit		.11½@.12
Imported fines, arsenical, per unit.		.09
Imported fines, non-arsenical, per unit		10½@11c.
Pyrite prices are per unit of sulphur. An allowance of 25c. per ton is made when delivered in lump form		
SALT—N. Y. com. fine 280 lb. bbl.		.72@1.13
N. Y. agricultural	sh. ton.	3.80@4.50
SALTPETER—Crude	100 lb.	4.00@4.50
Refined, crystals	"	5.50@6.00
SILICA—		
Ground quartz, ord'ry.	lg. ton.	10.00@15.00
Silex, ground	"	13.00@15.00
Silex, floated	"	35.00@40.00
Lump quartz	"	5.00@5.50
Glass sand	"	2.75
SILVER—Nitrate, crystals	oz.	.33½@.36¾
SODIUM—Acetate	lb.	.04½@.05
"Alkali," per 100 lb., 58/48		.80@.87½
Bicarb. soda, per 100 lb.		1.00@1.30c.
Soda, caustic, per 100 lb., 78/60		1.90@2.00
Soda, caustic, powdered		.02¾@.03½
Salt cake, per 100 lb., bulk		.40 up
Salt cake, bbl		.65@.85
Soda, monohydrate, per lb.		1.40@1.75
Bicromate	lb.	.06½@.06¾
Bromide	"	.20
Chlorate, com'l	"	.08½@.09½
Cyanide ("100% KCN")		
Carloads (30,000 lb.)	"	18c.
5-ton lots	"	18½c.
Less than 5 tons	"	19c.
Hyposulphite, Am.	"	1.30@1.50
German	"	1.60@1.70
Phosphate	100 lb.	2.20@2.50
Prussiate	"	.08½@.09
Sal soda, f.o.b. N. Y.	"	.65@.75
Foreign, f.o.b. N. Y.	"	.80@1.00
Silicate, com'l	"	.65@1.50
Sulphate, com'l (Glauber's salt)	100 lb.	.60@.80
Sulphate, com'l, calcined		.65@.85
STRONTIUM—Nitrate	lb.	.07½@.08
SULPHUR—Louisiana (prime) to New York	lg. ton.	22.00 up
To Boston, Philadelphia or Baltimore	"	22.50 up
Roll	100 lb.	1.85@2.15
Flour	"	2.00@2.40
Flowers, sublimed	"	2.20@2.60
Sicilian, extra qual., unmixed seconds, crude brimstone to New York	lg. ton.	$22.00
Other ports	"	22.50
TERRA ALBA—Fr. & Eng.	100 lb.	.80@1.00
TALC—Domestic	sh. ton.	15.00@20.00
French	"	15.00@25.00
Italian, best	"	30.00@40.00
TIN—Bi-chloride, 50%	lb.	.09
Crystals	"	.20½@.23
Oxide, lb.	"	.32½@.35
URANIUM—Oxide		3.50
ZINC—Chloride sol., com. 20°	"	.02½
Chloride, granular	"	.05@.06
Dust	"	.05@.05½
Sulphate	"	.02½@.03

*F.o.b. Florida or Georgia ports. †F.o.b. Mt. Pleasant. ‡On vessel Ashley River, S. C.

NOTE—These questions are for ordinary wholesale lots in New York unless otherwise specified, and are generally subject to the usual trade discounts. In the cases of some of the important minerals, such as phosphate rock, pyrites and sulphur, in which there are well established markets, the quotations fully represent the latter. But in the cases of some of the minor mineral products, the quotations represent what dealers ask of consumers and not what producers can realize in selling their outputs as matters of private contract.

Mining and Metallurgical Companies—U. S.

Name of Company and Location.		Shares. Issued.	Pa Val.	Dividends. Total to Date.	Latest. Date.	Amt.
Alaska, Mexican, g..	Alas.....	180,000	$ 5	$ 2,184,381	April '09	$0.40
Alaska Treadwell, g.	Alas.....	200,000	25	10,485,000	April '09	0.50
Alaska United, g...	Alas.....	180,200	5	513,520	April '09	0.25
Amalgamated, c....	Mont.....	1,538,879	100	70,018,993	May '09	0.50
Am. Sm.&Ref., com.	U. S.....	500,000	100	16,000,000	April 09	1.00
Am. Sm. & Ref., pf	U. S.....	500,000	100	30,625,000	April '09	1.75
Am. Smelters, pf. A	U. S.....	170,000	100	3,965,000	June '09	1.50
Am. Smelters, pf B.	U. S.....	300,000	100	6,000,000	June '09	1.25
Am. Zinc, Lead&Sm	Kan.....	80,000	25	280,000	Nov. '07	0.50
Anaconda, c.....	Mont.....	1,200,000	25	43,650,000	Jan. '09	0.50
Arizona, c.....	Ariz.....	3,682,520	....	6,182,520	April '06	0.50
Atlantic, c.....	Mich.....	100,000	25	990,000	Feb. '05	0.02
Bald Butte, g. s....	Mont.....	250,000	1	1,354,648	Oct. '07	0.04
Beck Tunnel, g. s. l.	Utah.....	1,000,000	0.10	675,000	Oct. '07	0.02
Bent'n M.&D.,pf.,l.z	Wis.....	196,607	1	10,949	Nov. '08	0.01½
Boston & Montana..	Mont.....	150,000	25	53,400,000	April '09	3.00
Bull.Beck. & Cham.g	Utah.....	100,000	10	2,728,400	July '08	0.10
Bunker Hill & Sull..	Ida.....	300,000	10	10,971,000	May '09	0.15
Butte Coalition, c. s.	Mont....	1,000,000	15	2,450,000	Dec. '07	0.15
Calumet & Arizona,c.	Ariz.....	200,000	10	10,500,000	May '09	1.00
Calumet & Hecla, c..	Mich.....	100,000	25	108,950,000	June '09	6.00
Camp Bird, g., s....	Colo.....	820,000	5	5,904,000	May '09	0.24
Carisa, c. g.....	Utah.....	500,000	1	55,000	Nov. '06	0.01
Colorado, l. g. s....	Utah.....	1,000,000	0.20	1,390,000	April '09	0.08
Columbus Con., c...	Utah.....	283,540	5	226,832	Oct. '07	0.20
Con. Mercur, g.....	Utah.....	1,000,000	1	3,385,313	Dec. '06	0.02½
Continental, z. l....	Mo.....	22,000	25	231,000	Oct. '08	0.25
Copper Range Con..	Mich.....	384,185	100	8,452,070	July '09	1.00
Creede United, g...	Colo.....	1,625,000	1	214,053	July '06	0.00½
Daly Judge, g. s. l..	Utah.....	300,000	1	225,000	April '07	0.37½
Daly West, g. s. l...	Utah.....	180,000	20	5,731,000	April '09	0.30
De Lamar, g. s.....	Ida.....	80,000	5	835,200	Sept. '06	0.24
Doe Run, l.....	Mo.....	59,062	100	1,859,893	Mar. '09	1.50
Elkton Con., g.....	Colo.....	2,500,000	1	2,316,959	April '09	0.01½
El Paso, g.....	Colo.....	2,450,000	1	1,315,545	Sept. '08	0.01
Fed. Sm., com.....	Idaho.....	60,000	100	2,708,750	Jan. '09	1.50
Federal Sm., pf.....	Idaho.....	120,000	100	4,751,250	June '09	1.75
Findley, g.....	Colo.....	250,000	1	337,500	Sept. '06	0.01
Florence, g.....	Nev.....	1,050,000	1	420,000	Nov. '08	0.10
Frances-Mohawk, g.	Nev.....	912,000	1	546,000	Jan. '08	0.05
Gemini-Keystone...	Utah.....	5,000	100	2,000,000	Aug. '07	10.00
Gold King Con.....	Colo.....	3,750,370	1	1,407,504	May '05	0.01
Goldfield Con., g....	Nev.....	3,546,013	10	2,834,232	July '09	0.30
Grand Central, g...	Utah.....	250,000	1	1,321,250	Dec. '07	0.04
Gwin Mine, Dev., g..	Cal.....	100,000	10	496,000	April '06	0.05
Hecla, s. l.....	Idaho.....	1,000,000	0.25	1,690,000	Dec. '08	0.01½
Homestake, g.....	S. D.....	218,400	100	24,372,440	May '09	0.50
Horn Silver, g.s.c.z.l.	Utah.....	400,000	25	5,642,000	Sept. '07	0.05
Imperial, c.....	Ariz.....	500,000	10	300,000	June '07	0.20
Inter'l Nickel, pf...	N. Y.....	89,126	100	1,871,646	May '09	1.50
Iron Blossom, s. l...	Utah.....	1,000,000	0.10	80,000	April '09	0.08
Iron Silver.....	Colo.....	500,000	20	4,100,000	Oct. '07	0.10
Jamison, g.....	Cal.....	390,000	10	347,100	April '09	0.02
Jerry Johnson.....	Cal.....	1,500,000	1	86,700	Jan. '08	0.01
Kendall, g.....	Mont.....	500,000	5	1,275,000	Oct. '08	0.02
Liberty Bell, g. s...	Colo.....	130,551	5	130,440	Jan. '07	0.15
Lightner, g.....	Cal.....	102,255	1	253,081	Oct. '06	0.05
Lower Mammoth, g.	Utah.....	190,000	1	57,000	Sept. '07	0.07½
MacNamara, s. g....	Nev.....	728,341	1	21,850	May '09	0.01
Mammoth, g. s. l...	Utah.....	400,000	2.50	2,220,000	Mar. '08	0.05
Mary McKinney, g..	Colo.....	1,309,252	1	841,093	Dec. '08	0.02
May Day, g. s. l....	Utah.....	800,000	1	108,000	Sept. '08	0.01½
Mohawk, W.....	Mich.....	100,000	25	1,850,000	Feb. '09	2.00
Mont. Ore Purch...	Mont.....	80,833	25	9,437,274	Jan '07	15.00
Nevada Hills, s.g...	Nev.....	746,000	5	373,000	Dec. '07	0.10
New Century, z. l...	Mo.....	300,000	1	213,000	Dec. '06	1.01
Newhouse M. & S. c.	Utah.....	600,000	10	300,000	Sept. '07	0.50
New Idria, q.....	Cal.....	100,000	5	1,080,000	Jan. '09	0.30
New Jersey Zinc....	U. S.....	100,000	100	12,000,000	May '08	4.00
North Butte.....	Mont.....	400,000	15	7,200,000	June '09	1.00
North Star, g.....	Cal.....	250,000	10	1,911,988	Mar. '09	0.30
Old Dominion, c....	Ariz.....	293,245	25	849,332	Mar. '09	0.50
Old Dominion,M&Sc	Ariz.....	162,000	25	526,500	Mar. '09	1.00
Ophir, g. s.....	Nev.....	201,600	3	1,816,360	May '08	0.10
Osceola, c.....	Mich.....	96,150	25	7,420,250	Jan. '09	2.00
Parrot, c. s.....	Mont....	229,850	10	6,807,649	Sept. '07	0.25
Pennsylvania, g....	Cal.....	51,500	100	284,925	July '05	0.10
Phelps, Dodge & Co.	U. S.....	44,934,600	1	1,123,365	April '09	0.02½
Portland, g.....	Colo.....	3,000,000	1	8,227,080	Jan. '09	0.40
Quartette, g. s.....	Nev.....	100,000	10	375,000	July '07	0.20
Quincy, c.....	Mich.....	110,000	25	18,560,000	Mar. '09	1.00
Sacramento, g. q...	Utah.....	1,000,000	1	225,000	Nov. '06	0.00½
St. Joseph, l.....	Mo.....	1,000,000	10	6,308,357	Mar. '09	0.15
Shannon, c.....	Ariz.....	300,000	10	450,000	July '07	0.50
Silver Hill, g. s....	Nev.....	108,000	1	81,000	June '07	0.05
Silver King, g. s. l.†	Utah.....	150,000	20	11,187,500	July '07	0.33½
Silver King Co't'n.†	Utah.....	1,224,425	5	1,105,402	April '09	0.15
Sioux Con.....	Utah.....	746,389	1	335,595	April '09	0.07
Snowstorm, s. l.....	Ida.....	1,500,000	1	735,000	May '09	0.03
Standard Con., g. s..	Cal.....	178,394	10	5,194,130	Dec. '08	0.10
Stratton's Independ.	Colo.....	1,000,000	5	4,895,865	April '06	0.12½
Swansea, g. s. l....	Utah.....	100,000	5	329,500	Mar. '07	0.05
Tamarack, c.....	Mich.....	60,000	25	9,420,000	July '07	4.00
Tennessee, c.....	Tenn.....	200,000	25	2,056,250	Sept. '08	1.25
Tomboy, g. s.....	Colo.....	300,000	5	2,016,000	Dec. '08	48
Tonopah of Nev....	Nev.....	1,000,000	1	4,600,000	April '09	0.35
Tonopah Belmont..	Nev.....	1,500,000	1	600,000	April '07	0.10
Tonopah Ext'nsion..	Nev.....	928,433	1	283,030	April '06	0.15
Tonopah Midway...	Nev.....	1,000,000	1	250,000	Jan. '07	0.05
Uncle Sam, g. s. l...	Utah.....	500,000	1	295,000	Dec. '08	0.02
United States, com..	Utah.....	350,933	50	2,148,099	April '09	0.50
United States, pfd.*.	Utah.....	485,845	50	5,306,495	April '09	0.87½
United Cop. com...	Mont.....	450,000	100	5,962,500	Aug. '07	1.75
United, c. pf.....	Mont.....	50,000	100	1,500,000	May '07	3.00
United, z. l., pf....	Mo.-Kan.	19,556	25	312,782	Jan. '08	0.50
United Verde, c....	Ariz.....	300,000	10	1,385,322	Mar. '09	0.75
U. S. Red. & Ref. Pf.	Colo.....	39,458	100	1,005,504	Oct. '07	1.50
Utah, g. (Fish Sp'gs)	Utah.....	100,000	10	323,000	Feb. '09	0.02
Utah Con., c.....	Utah.....	300,000	5	7,500,000	April '09	0.50
Utah Copper.....	Utah.....	727,100	10	1,423,487	June '09	0.50
Victoria, Utah.....	Utah.....	250,000	1	177,000	Mar. '07	0.04
Vindicator Con., g..	Colo.....	1,500,000	1	1,980,000	Jan. '09	0.03
Wolverine, c.....	Mich.....	60,000	25	5,400,000	April '09	5.00
Work, g.....	Colo.....	1,500,000	1	172,500	July '08	0.01
Yankee Con.....	Utah.....	1,000,000	1	182,500	Jan. '07	0.03
Yellow Aster, g....	Cal.....	100,000	10	958,789	Aug. '07	0.20

*Previous to consolidation $1,436,250 were divided. †Amalgamaetd.

Coal, Iron and Other Industrials—United States

Name of Company and Location.		Shares. Issued.	Par Val.	Dividends. Total to Date.	Latest. Date.	Amt.
Allis-Chalmers, pf...	U. S.....	161,500	100	$3,108,875	Feb. '04	$1.75
Amer. Ag. Chem., pf.	U. S.....	181,530	100	1,747,620	April '09	3.00
American Cement...	Pa.....	200,000	10	1,288,000	Jan. '09	0.30
American Coal.....	Md.....	50,000	25	2,555,000	Mar. '09	1.25
Bethlehem Steel, pf.	Pa.....	150,000	100	900,000	Nov. '06	0.75
Cambria Steel.....	Pa.....	900,000	50	9,450,000	Feb. '09	0.75
Central C. & C., com.	Mo.....	51,250	100	2,613,750	April '09	1.50
Central C. & C., pf...	Mo.....	18,750	100	1,476,562	April '09	1.25
Col.&Hock. C.&I.,pf.	Ohio.....	69,244	100	383,818	April '08	1.50
Consolidated Coal...	Ill.....	50,000	100	350,000	July '04	1.00
Consolidation Coal..	Md.....	102,500	100	x10 431,650	Jan. '09	3.50
Crucible Steel, pf....	Pa.....	244,365	100	8,430,593	Mar. '09	1.00
Empire S. & I., pf...	N. J.....	25,000	100	933,033	Jan. '09	1.50
Fairmont Coal.....	W. Va...	120,000	100	1,980,000	Jan. '09	2.00
Gen. Chem., com...	U. S.....	74,103	100	2,297,193	June '09	1.00
General Chem., pf..	U. S.....	100,000	100	6,255,000	Jan. '09	1.50
International Salt...	Penn.....	182,280	100	911,400	Dec. '06	1.00
Jeff.&Cl'f C.&I., cm.	Pa.....	15,000	100	330,000	Aug. '05	5.00
Jeff.& Cl'f C. & I., pf.	Pa.....	15,000	100	900,000	Feb. '09	2.50
Kern River Oil.....	Cal.....	20,000	100	84,000	July '08	0.10
Lehigh Coal & Nav..	Pa.....	382,260	50	15,779,410	May '09	2.00
Maryland Coal, pf..	Md.....	18,850	100	‡2,013,997	Dec. '08	2.50
Monon R. Coal, pf...	Pa.....	100,000	100	2,324,000	July '08	3.50
Nat. Carbon, com...	U. S.....	55,000	100	715,000	April '08	1.00
Nat. Carbon, pf....	U. S.....	45,000	100	3,071,250	Nov. '08	1.75
National Lead, com.	N. Y.....	149,054	100	3,456,497	July '09	1.25
National Lead, pf...	N. Y.....	149,040	100	18,155,068	Mar. '09	1.75
Nat'l Steel&Wire,pf.	N. Ye....	25,778	100	631,561	May '06	1.75
New Central Coal...	Md.....	50,000	20	390,000	Nov. '08	0.40
New River Coal, pf..	W. Va...	37,617	100	451,405	Nov. '08	1.50
Pacific Coast Borax.	Cal.....	19,000	100	2,086,500	Aug. '05	1.00
Peerless Oil.....	Cal.....	92,000	10	711,000	June '08	0.06
Penna. Salt.....	Pa.....	60,000	50	15,098,000	Oct. '08	3.00
Penna. Steel, pf.....	Pa.....	165,000	100	8,662,500	Nov. '08	3.50
Phila. Gas, com.....	Pa.....	664,800	50	*24,264,600	Feb. '09	0.75
Phila. Gas, pf.....	Pa.....	129,000	50	2,850,000	Sept. '08	1.25
Pittsburg Coal, pf...	Pa.....	297,010	100	11,434,962	April '09	1.75
PocadontasC.C., pf.†	W.sVa...	28,000	100	252,000	Jan. '09	3.00
Pocah'tasC.C., cm.†.	W. Va...	45,000	100	†406,800	Oct. '08	3.00
Republic I.&S., pfd.	Ill.....	204,169	100	6,045,338	April '08	1.75
Sloss-Sheffield, com.	Ala.....	100,000	100	2,133,000	June '09	1.25
Sloss-Sheffield, pf...	Ala.....	67,000	100	4,221,000	Jan. '09	1.75
Standard Oil.....	U. S.....	970,000	100	652,802,905	June '09	9.00
Tenn. C. & I., com...	Tenn.....	225,536	100	3,583,060	Nov. '07	1.00
Tenn. C. & I., pf...	Tenn.....	2,480	100	390,040	Nov. '07	2.00
Texas & Pacific Coal.	Texas....	23,940	100	1,747,620	April '09	1.50
Uni. Metals Selling..	U. S.....	50,000	100	5,875,000	Jan. '09	5.00
U.S. Steel Corp., cm.	U. S.....	5,083,025	100	83,848,056	Mar. '09	0.50
U. S. Steel Corp., pf.	U. S.....	3,602,811	100	231,585,110	Mar. '09	1.75
Va. Carolina Ch., pf.	U. S.....	180,000	100	14,700,869	April '09	2.00
Warwick I. & S....	U. S.....	148,671	10	517,739	Nov. '08	0.30
Westmoreland Coal.	Pa.....	60,000	50	8,880,000	Oct. '08	2.50

*Since 1894. †Since 1907. ‡Since 1890. xStock div. $6,130,000 Mar. '09

Canada, Mexico, Central and South America

Name of Company and Location.		Shares. Issued.	Par Val.	Dividends. Total to Date.	Latest. Date.	Amt.
Amistad y Conc'rdia	Mex.....	9,600	50	$417,070	April '98	$1.36
Batopilas.....	Mex.....	446,268	20	†55,784	Dec. '07	0.12½
British Columbia, c.	B. C.....	503,000	5	201,200	Sept. '07	0.40
Buffalo, s.....	Ont.....	900,000	1	399,000	May '09	0.01
Butters' Salvador, g.	Salv.....	150,000	5	600,000	April '05	0.25
Cobalt Central, s...	Ont.....	4,761,500	1	139,845	May '09	0.01
Coniagas, s.....	Ont.....	800,000	5	720,000	July '08	0.15
Consolidated M. & S.	B. C.....	53,552	100	781,885	Nov. '07	1.25
Crow's Nest Pass....	B. C.....	160,000	25	2,018,648	July '07	0.62½
Crown Reserve, s...	Ont.....	1,750,000	1	612,500	Mar. '09	0.15
Dolores, g. s.....	Mex.....	400,000	5	660,000	Aug. '09	0.15
Dominion Coal, com.	N. S.....	150,000	100	3,150,000	Jan. '09	1.00
Dominion Coal, pf..	N. S.....	30,000	100	‡630,000	Feb. '08	3.51
Dos Estrellas, g. s...	Mex.....	300,000	0.50	3,780,000	Jan. '09	1.00
El Oro, g. s.....	Mex.....	1 080,000	5	4,989,600	July '08	0.36
Esperanza, s. g.....	Mex.....	455,000	5	9,390,400	Mar. '08	0.37
Foster Cobalt, s....	Ont.....	1,000,000	1	50,000	Jan. '07	0.05
Granby CWn.....	B. C.....	135,000	100	3,508,630	Dec. '08	2.00
Greene Con. Copper.	Mex.....	864,000	10	6,137,800	Mar. '07	0.40
Guanajuato.....	Mex.....	540,000	5	74,250	Oct. '06	0.07
Guanajuato D., pf. s.	Mex.....	10,000	100	30,000	July '08	3.00
Guggenheim Expl...	Mex.....	105,000	100	5,535,000	July '09	2.50
Hinds Con., g. s. c. l.	Mex.....	5,000,000	1	100,000	Feb. '08	0.02
Kerr Lake, s.....	Ont.....	600,000	5	1,108,000	June '09	0.30
La Rose Con., s....	Ont.....	1,143,368	5	628,252	April '09	0.20
Le Roi, Ltd., g.....	B. C.....	200,000	25	425,000	Dec. '06	0.48
Le Roi No. 2, g.....	B. C.....	120,000	25	889,200	Mar. '09	0.48
Luck y Tiger-Com., g.	Mex.....	65,000	10	71,500	Dec. '08	0.30
McKinley-Darragh, s.	Ont.....	2,000,000	1	480,000	Jan. '09	0.05
Mex. Con. M.&S. Co.	Mex.....	240,000	10	660,000	Mar. '08	0.25
Mex. Mill.&Trans.pf.	Mex.....	12,000	100	35,450	Jan. '08	3.00
Mines Co. of Am....	Mex.....	2,000,000	1	3,605,000	Aug. '09	0.03
N. Y. & Hond. Ros..	C. A.....	150,000	10	2,497,000	May '09	0.10
Nipissing, s.....	Ont.....	1,200,000	5	2,640,000	April '09	0.25
N. S. St.&Coal, com.	N. S.....	9,876	100	1,087,856	April '08	1.50
N. S. St. & Coal, pf..	N. S.....	10,300	100	479,130	April '09	2.00
Penoles*.....	Mex.....	2.500	100	8,630,000	Dec. '07	20.00
Peregrina, pf. s.....	Mex.....	10,000	100	538,656	Mar. '09	3.50
Pinguico, pf. s.....	Mex.....	20,000	100	240,000	Oct. '08	3.00
Reco, g. s. l.....	B. C.....	985,000	1	527,082	April '06	0.02
Right of Way.....	Ont.....	499,518	1.00	264,701	May '09	0.10
Securities Corp., pf..	Mex.....	2,000	100	42,699	July '08	3.50
Silver Queen, s.....	Ont.....	1,500,000	1	345,000	Nov. '08	0.05
Temiskaming, s....	Ont.....	2,500,000	1	525,000	April '09	0.06
Tezuitlan Copper...	Mex.....	10,000	100	.....	Dec. '08	1.20
Tilt Cove, c.....	N. F.....	89,000	2	495,630	May '08	0.55
Tretheway, s.....	Ont.....	945,450	1	311,998	May '09	0.10
Tyee, c.....	B. C.....	180,000	5	201,600	Aug. '07	0.63

*Mexican Currency. †Since reorganization. ‡Since August, 1905.

Industrials

The Pneumelectric Machine Company, of Syracuse, N. Y., has established a new agency with Eastin & Haley, in the Madisonville Savings Bank building, Madisonville, Ky.

Traylor Engineering Company, Allentown, Penn., reports that it has just closed an order with the Boston Idaho Mining Company, of Boston, Mass., for a 100-ton concentrating plant.

It is reported that the Berwind-White Coal Mining Company, Windber, Penn., has installed four more Pneumelectric coal punchers. This brings the total up to twenty-six now in use by this company.

Du Bois Iron Works advises that its office, formerly located at 1206 Park building, Pittsburg, Penn., and managed by G. E. Webb, has been moved to 1429 Park building, giving more commodious quarters.

The John Simmons Company, 102 Centre street, New York City, has about perfected the new Baldwin acetylene safety lamp. It is constructed on lines as simple as the regular models and is also about the same size and weight as the present type of safety lamp.

The C. O. Bartlett & Snow Company reports the following recent orders: Benson Mines Company, Benson Mines, N. Y., one skip hoist; Geo. H. Clippert & Bro. Brick Company, Detroit, Mich., one low-pressure brick dryer, capacity 30,000 brick per day; Baldwin Bros., Cleveland, Ohio, one gravel outfit for disintegrating, elevating, screening and washing gravel.

A report has been circulated that the Ottumwa Iron Works, Ottumwa, Iowa, has been totally destroyed by fire. This report probably originated from the burning of the foundry roof. The damage has, however, not only been repaired, but the foundry has been enlarged and improved machinery added to increase the output and the quality of the product of the company.

The C. O. Bartlett & Snow Company announces that owing to the increased eastern business of the company, it has established an office at 50 Church street, New York City, in charge of H. H. Bighouse, chief engineer, who will give personal attention to all matters pertaining to the elevating, conveying and economical handling of materials, as well as mechanical drying and other lines of the business.

Chalmers & Williams, Inc., Chicago, Ill., report the following sales: Five stamp mill to M. K. Rodgers, Alaska; No. 5 Kennedy gyratory crusher, two sets of 36-in. by 14-in. rolls and twelve 6-ft. frue vanners to Bunker Hill and Sullivan Milling and Construction Company; 3½-ft. Huntington mill plant for Cape Gracias, Nic.; No. 6 Kennedy gyratory crusher, with screen and elevator, to Arthur McMullen and Company, New York City.

Asa Whitney, formerly of A. Whitney & Sons' Carwheel Works, Philadelphia, who has been for some years secretary and metallurgist of the Sanford-Day Iron Works, Knoxville, Tenn., has severed his connection with that company and will engage in the manufacture of mine equipment and car wheels at Bristol, Tenn. Mr. Whitney is a grandson of Asa Whitney, a pioneer in the manufacture of chilled wheels and at one time president of the Philadelphia & Reading Railway.

Penberthy Injector Company, Detroit, Mich., offers to send sample copy of "The Penberthy Engineer and Fireman" free. The subscription price is 50 cents a year, including a handsome silver-finish watch fob premium. The magazine does not write up the company or any other concern. Its circulation is 10,000 copies each month and it has over 3500 paid subscribers, contains 80 pages of choice, interesting, instructive reading. Handsome cover and good quality paper throughout.

Circular 1502 issued by the Westinghouse Electric and Manufacturing Company contains much valuable information on alternating current distribution covering transformers, lightning arresters, insulators, cross arms, etc. Considerable space is devoted to underground and overhead construction applicable to congested and scattered districts. There is also given information on potential regulating systems. The circular contains 52 pages of information of value to any central station man or any other connected in any way with the distribution of power by alternating current lines.

Since the appearance on the market of ready roofings that need no painting, there has been a very lively curiosity on the part of many people to see the goods. Accordingly the makers of Amatite have arranged to supply samples to any inquirer free of charge. These samples show the goods complete with the mineral surface which replaces paint as a protection against the weather, and it is easy to obtain a very good idea of just what Amatite is like. All you have to do in order to obtain the sample is to send a postal card request for same to the nearest office of Barrett Manufacturing Company, at New York, Chicago, Philadelphia, Boston, Cincinnati, Cleveland, Pittsburg, Minneapolis, St. Louis, Kansas City or New Orleans.

Foote Mineral Company has issued the twelfth edition of its complete mineral catalog, compiled by W. M. Foote. This notable compend is of permanent value to the field amateur, as well as the professional mining man. The present volume has been completely overhauled by the compiler from cover to cover and embodies an inexhaustible fund of information relative to metalliferous minerals, including important data on the rare metals which will intuitively appeal to the student and all around mining man. The work adheres closely to the Dana system and the different types and varieties follow each species heading with more elaborate descriptions of the forms and physical characters of each than was practical in earlier issues. The catalog will prove a useful addition to the industrial library of the professional worker.

A large installation of squirrel-cage induction motors, aggregating 2200 h.p., is being made at the Bonnie Cotton Mills, Kings Mountain, N. C. These motors, which have been furnished by the Crocker-Wheeler Company, of Ampere, N. J., will operate on a 2080-volt, 3-phase, 60-cycle circuit. There are 32 machines in all, varying in output from 20 to 100 h.p. Each unit is controlled from a separate panel, built of Blue Vermont marble. Two 10-kw., 2200/ 110 volt-Crocker-Wheeler transformers will also be installed in this plant. The Youngstown Sheet and Tube Company, Youngstown, Ohio, has added to its 5000 h.p. of Crocker-Wheeler motors by installing a 500-h.p. synchronous motor. This machine will operate on a 3-phase, 25-cycle circuit at the unusually high potential of 6000 volts. It will be used to drive a centrifugal pump. The Indiana Steel Company, Gary, Ind., has placed an order for twenty-one form W motors, aggregating 655 h.p., of the type developed by the Crocker-Wheeler Company for rolling-mill service. These machines will be used to operate cranes on a 220-volt, direct-current circuit.

A. Leschen & Son Rope Company has just issued a very handsome book of views, entitled "Over the Waters of Lake Michigan." The various views in this pamphlet show the construction and arrangement of the Leschen company's patent friction grip wire rope tramway furnished to the George W. Jackson, Inc., Chicago, Ill. The tramway is 8000 ft. long and, with the exception of a few hundred feet, is built over Lake Michigan—connecting a temporary crib out in the lake with the shore. The tramway is used to transport rock and other material excavated in the construction of the new water supply tunnel for Chicago. The excavated material is elevated through a shaft in the crib out in the lake and is then loaded into the tramway carriers or buckets. At the land terminal the rock is discharged into bins, where it is later crushed for the making of concrete. The workmen go to and from the crib over the tramway in specially designed carriages. The carriers hold an average of 1000 lb. of material each and are fitted with a patent friction grip, whereby each carrier is automatically released from the rope on entering a terminal station. By means of a series of overhead rails it is possible to move the carriers to any desired point for loading or discharging. The gripping of the carriers to the rope is performed mechanically. The power necessary to operate the system is applied through bevel gearing at the shore terminal.

Trade Catalogs

Denver Fire Clay Company, Denver, Colo. Bulletin. Iler disc pulverizer. Illustrated.

Sullivan Machinery Company, Chicago, Ill. Booklet. Air compressors. Illustrated, 20 pages, 3½x6 inches.

The Goulds Manufacturing Company, Seneca Falls, N. Y. Catalog. Power pumps. Illustrated, 188 pages, 7x8 inches, paper.

The Ball & Wood Company, Elizabethport, N. J. Catalog. Rateau-Smoot turbines and generators. Illustrated, 6x9 inches, paper.

Joseph Dixon Crucible Company, Jersey City, N. J. Booklet. Valuable graphite products. Illustrated, 22 pages, 3½x6 inches, paper.

Jacobson Machine Manufacturing Company, Warren, Penn. Bulletin No. 27. Gas and gasolene engines. Illustrated, 24 pages, 6x9 inches.

Alberger Condenser Company, 95 Liberty street, New York. Catalog No. 13. Wainwright water heaters. Illustrated, 16 pages, 6x9 inches.

Robins New Conveyor Company, 72 Front street, New York. Catalog. Robins genuine Balata belting. Illustrated, 14 pages, 3½x6 inches, paper.

American Electric Furnace Company, 45 Wall street, New York. Bulletin. Rochling-Rodenhauser and simple induction furnaces. Illustrated, 24 pages, 9x12 inches.

C. W. Hunt Company, 45 Broadway, New York. Pamphlet No. 094. Mast and gaff automatic railways, coal tubs, hoisting blocks, etc. Illustrated, 8 pages, 6½x9 inches.

Keuffel & Esser Co., Hoboken, N. J. 1909 catalog. Drawing materials, engineering and surveying instruments, drafting-office furniture. Illustrated, 540 pages, 6x9 inches, cloth.

The Hartz Machinery Company, 607 Arch street, Philadelphia, Penn. Catalog No. 3. Power transmitting machinery and supplies. Illustrated, 36 pages, 3½x6 inches, paper.

Fairbanks, Morse & Co., Chicago, Ill. General Catalog No. 60. Hoisting engines, motors, locomotives, cars, pumps, drills, valves, scales, etc. Illustrated, 640 pages, 6x9 inches, cloth.

Ingersoil-Rand Company, 11 Broadway, New York. Bulletin, Form No. 3001. Air and gas compressors. Illustrated, 16 pages, 6x9 inches. Form No. 4010. Telescope feed hammer drills. Illustrated, 28 pages, 6x9 inches. Form No. 6002. Gibson-Ingersoll electric-air track channeler. Illustrated, 8 pages, 6x9 inches.

Westinghouse Electric and Manufacturing Company, Pittsburg, Penn. Circular No. 1148. Mercury rectifier battery charging outfits. Illustrated, 20 pages, 7x10 inches. Circular No. 1158. Electric motor friction brakes. Illustrated, 14 pages, 7x10 inches. Circular No. 1165. Electric fans. Illustrated, 36 pages, 7x10 inches.